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Electrical World

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Electrical World

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July 25, 1942

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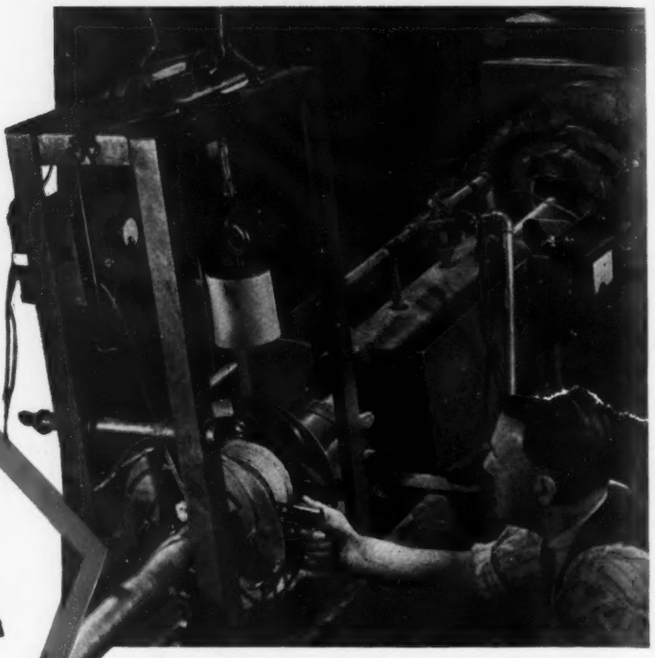
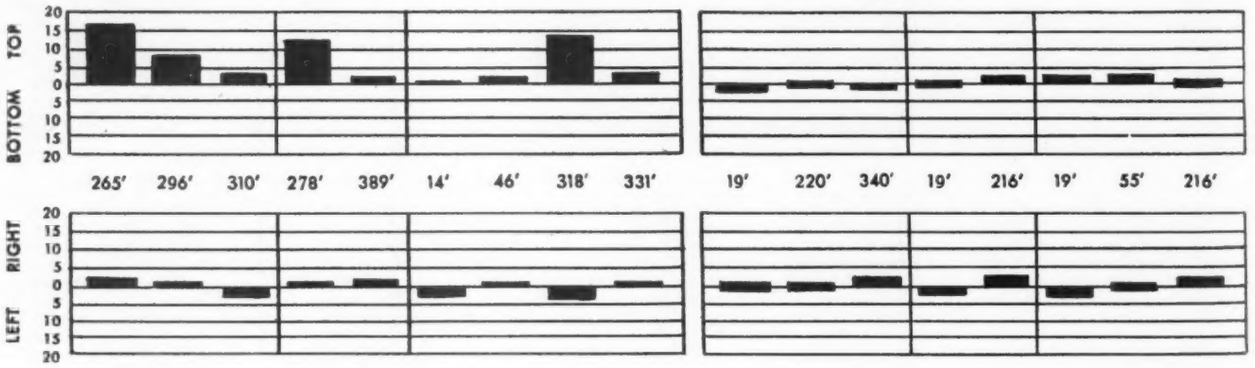
THE MAGIC EYE THAT "SEES" THROUGH LEAD

from *OKONITE-CALLENDER RESEARCH* comes this electric gauge that measures and controls lead sheath concentricity



● Okonite-Callender Concentricity Gauge in operation at lead press.

● THESE CURVES QUICKLY GIVE YOU ACTUAL FIGURES on the concentricity obtained with Okonite-Callender Sheaths in actual day to day production. (Left) Before the development of the Concentricity Gauge. (Right) With the adoption of the Concentricity Gauge, note the close control of Okonite-Callender Lead Sheaths.



Many a paper cable that looked good at both ends has failed because the lead sheath was thin at some in-between point. There just was no way to measure lead thickness in the middle of a length.

With even X-rays unable to penetrate lead, it looked like an impossible job to solve this troublesome problem in paper cable manufacture. But Okonite-Callender research engineers stuck to the job and finally developed an ingenious gauge that determines lead thickness electrically.

This concentricity gauge instantly measures the slightest deviation in sheath thickness — top, bottom and either side — thus permitting immediate adjustment of the lead press to keep the sheath uniform. Proof of the advantage of using this device is shown in the accompanying charted measurements on typical production runs of Okonite-Callender paper-insulated power cables.

Here is one more example of the increased uniformity continually being added to paper cables by Okonite-Callender Research. This outstanding stability of lead sheaths, conductors and insulation is why Okonite-Callender paper-insulated cables constantly set new records for long, dependable service.

THE OKONITE-CALLENDER CABLE CO., INC.
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OKONITE CALLENDER
Paper Insulated Cables

Machine Tool Builders . . .

the men behind our war production achievement

IT TOOK GERMANY six years to get ready for this war, and Japan even longer. But in less than twenty-four months American industry, starting from scratch, has caught up with and surpassed the war production of the Axis.

When France fell in June, 1940, we unfortunately had no gigantic munitions makers, like the Krupp or Skoda works, to turn to. We had been devoting our attention to making refrigerators and vacuum cleaners and motor cars and lawn mowers. Ordnance output for our Army was a mere million dollars a month. A sad commentary on our National state of mind and our lack of responsible political leadership.

Yet during June of this year, our industries, transformed from peacetime pursuits, produced close to a thousand times that amount. A thousand-fold increase in two years!

The same spectacular gains hold throughout our war program—for ships, planes, guns, tanks, a thousand items. We are well on our way toward the 60,000 planes, 20,000 anti-aircraft guns, 45,000 tanks and 8,000,000 tons of shipping that the President asked us to produce in 1942, and toward the much larger production projected for the year 1943.

We are well on our way thanks to a number of factors, one of the most vital being the extraordinary job done by the machine tool industry. For it has equipped America's metal-working shops with the tools they need to turn out the vast quantities of war weapons.

The machine tool industry's importance springs from the fact that almost every metal product, from mechanical pencils to giant guns, is made with machine tools. They transform pieces of steel into parts for automobiles, farm implements and radios—and for airplanes, guns and tanks.

The Garand rifle, highly praised by General MacArthur at Bataan, has 72 metal parts requiring 1040 separate cutting operations on machine tools. A 40-millimeter gun mount is made up of 1500 separate parts, built to the tolerance of a Swiss watch. Each part must be machined, not once, but several times.

No wonder that when the American defense program was undertaken two summers ago, the American machine tool industry was the first to be called into service. Ninety-five thousand machines were wanted as quickly as possible from 250 builders who in peacetime had produced some 25,000 machines a year.

But the demand did not stop there. The Army, the Navy and the Air Force kept asking for more as the war production program was expanded again and again. Nor was that all. The entire anti-Axis world besieged Washington with urgent requests—from London to Moscow, from Ottawa to Chungking.

To a man the machine tool builders responded. New factories and additions to old plants were built, with deliberate disregard of the prospect that all these sharply expanded facilities could not be used after the war.

To increase output from existing plants practically every company went to two long shifts or three short ones. The industry's work-week was greatly extended. From the beginning of our effort, it has been the longest of any industry.

Working forces were enlarged from 40,000 to 110,000, and this latter figure does not include tens of thousands of employees with sub-contracting firms. Though machine tool building requires a higher degree of individual skill than most products, "learner" courses have been set up to train men quickly. Over 15,000 men and women now are in training.

The machine tool builders were among the first to go in for sub-contracting. They have farmed out parts, subassemblies and complete

machines right and left. To meet their needs, for example, repair shops of carpet mills are making milling machines, a laundry machinery company is producing radial drills, and an automobile body builder is making planers and boring mills.

Machine tool manufacturers quickly shelved peacetime practices to concentrate manufacture on the sizes and types of machines critically needed for the war program. They adopted mass production methods wherever possible, although machine tools are essentially a tailor-made product. They sent their sales engineers, as did machine tool dealers also, to hundreds of munitions makers with invaluable advice as to tooling up most efficiently for their particular jobs.

The swift action taken by the machine tool builders shows what private enterprise can do to meet a national emergency. They were the first to institute a voluntary system of priorities.

All of this involved an almost explosive expansion of the industry. Machine tool builders produced an average of only 7,500 machines a year from 1931 to 1934. In an ordinary year, output totals 25,000 machines. But in 1940, it rose to 112,500, and in 1941 to 187,500.

The 95,000 machine tools wanted for the original defense program were built and delivered within eight months.

Today more than 1,000 machine tools are being shipped to war factories every twenty-four hours, and for seven days a week. Each month's output exceeds that of an entire normal peacetime year and is five times that of the depression year of 1932. And each succeeding month is shattering all previous records.

It is this amazing performance that led Under Secretary of War Robert P. Patterson to declare that "machine tools are the foundation on which our production structure is built. American machine tool men are doing a stupendous job. Machine tools are now being turned out at a rate of $1,380,000,000 a year. Machine tool designers have worked to improve tools so much that machine tool effectiveness today is one-third to one-half greater than it was in 1930. Our production today is 16 times what it was—in capacity to cut metal—at the peak of the World War."

The results of this performance by this key industry, so satisfying to the Nation, do not spring wholly from the numbers of machine tools produced. They stem also from their improved quality and greater productivity.

Today's warfare differs radically from that of 1917-1918. It calls for mechanized weapons so complicated in design and built to such a fine degree of accuracy that they are beyond comparison with the weapons of a generation ago.

Machine tools, completely redesigned during the depression years, are meeting these new and exacting requirements. In addition, thousands of machine tools of special design, without counterpart in peacetime work, have been built.

The record of the war industries most directly dependent on the machine tool industry speaks for itself. One tank manufacturer alone is producing more than thirty big tanks a day. A midwestern plant is completing 35 anti-aircraft guns a day, round the clock without interruption. A tank engine factory, tooled up to make 650 units a month, is actually building over 1500 a month. Demolition bombs, destined for Berlin and Tokyo, are being made by the tens of thousands every month. Machine guns are being produced at a rate of 50,000 a month.

These manufacturers, all machine tool users, are far in advance of the timetables set for them.

All this is good news for the American people and bad news for the Axis. It is proof that American industry, with each individual and specialized industry doing its part, is living up to the faith put in it by the American people.

But it is more than that, too. It is a guarantee of our confidence in the peacetime future of American industry and of the free enterprise system under which this miracle has been wrought.

Perhaps more than anything else, the foundation of that confidence must be faith in the farsightedness, the ingenuity, the engineering and designing skill, and the managerial know-how of the machine tool makers.

On them we depend for the most essential tools of the post-war production economy. Without them, our vision of better living standards and full employment through more efficient production and distribution can never be more than a vision.

What they have done as the toolmakers for war is proof of what they can do as the toolmakers of peace. How they have done it as free men is a demonstration of what free men will do.

James H. McGraw Jr.

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

Beehives

Just as the continuance of many businesses and personal activities is being placed in the scales of war essentiality so will many associations be put to the test to prove their value to their members and to the nation in these times. The test in some instances will be particularly severe because the money available from dues will be less and the pressure to keep up certain peacetime commitments will be very strong.

A great many associations have continuing programs, or standardization studies, or compilations of recommended practices for peacetime operations. Normally these activities are very much worth-while. To what degree should they be maintained now when committee members are so busy with their own jobs and when the standards or recommendations cannot be put into practice?

Obviously it would be poor policy to let everything drift that did not have a direct connection with the war. Certain jobs are near completion upon which considerable time and thought have been spent. To table the project until after the war might mean doing the job over completely from scratch. Certainly, however, nothing new should be started at this time unless it had some definite relationship to the war. Later perhaps when we are able to see ahead a little more clearly post-war planning should be in order.

Ordinarily association committees, being composed of voluntary workers, tackle their jobs in a somewhat deliberate and oft-times leisurely manner under the theory that haste makes waste. Every action, every statement must be subjected to the most careful scrutiny involving endless correspondence and conference. Time then is not the essential thing, correctness is. But that isn't so today. We cannot wait for weeks and weeks to get something done. Are electrical industry associations gearing their operations for more speed and perhaps less exactness?

While normally association activities are directly the reflection of the thinking of the officers, or the small number of willing interested workers, should they not in times such as these more nearly reflect the desires and needs of the membership as a whole? For instance, do the members want meetings? How often? What do they want to have discussed? Are the program chairmen in full understanding of the wants of the members?

In times like these associations also have the opportunity of being the focal point for cooperation with the war agencies. Government frequently needs quickly to contact industries and groups. It should be able to do so through bodies that are representative and organized to work in this manner. Have our associations war cooperation policies—not resolutions of willingness to help, but actual working policies? Have they really tried to learn how they can help?

Associations can be of great value today to their many members who are facing new problems with unfamiliar personnel and materials and with a growing number of war imposed official limitations and to their government which needs the civilian cooperation and help in every possible way. In normal times associations may be deliberate but in war they must be live, throbbing, energetic beehives of community activity.

Detroit Pioneers With 120-Kv. Pipe-Type Gas-Filled Cable—II

Novel construction operations mark installation of high pressure nitrogen filled, pipe-type cable — Pre-coated steel pipe welded in trench, dried to 0.06 grain moisture per cu.ft. tested to 500 lb. psi. and evacuated to less than 2 mm. of Hg before filling with gas at 200 lb. psi.

G. B. McCABE and F. M. HULL†, Detroit Edison Company*

PLACED IN SERVICE in Detroit on December 31, 1941, was a 120,000-volt, 100,000-kva., high-pressure, gas-filled cable which was described in Part I of this article.‡ The line is 35,130 ft. long, consists of three 600,000-circ.mil single-conductor cables, each insulated with 0.6 in. of pre-impregnated paper, each electrically shielded, and installed without lead sheath in a steel pipe containing nitrogen at 200 psi. gage pressure. The pipe is protected from corrosion by a ½-in. covering of "Somastic," an asphaltic coating applied by an outside contractor, and buried in the ground with a minimum cover of 42 in.

Majority of the line is located in residential districts. It contains sixteen 90-deg. turns, crosses seven main traffic arteries and four railroad grade crossings (one of 20 tracks), passes under two viaducts, and for approximately four blocks crosses filled land that was once a city dump. Over two-thirds of the route the line was installed beneath pavement or sidewalk.

The trench was 24 in. wide. Considerable care was exercised to remove all cinders, stones, broken pavement and other hard objects from the trench bottom and from the initial layers of backfill to prevent injury to the Somastic coating when the backfill was tamped into place. In some cases all excavated material was drawn away and the entire backfill was made with bank sand.

Thirty brick manholes were used to break the pipe lines into sections

IN STORAGE tin caps (right) seal ends of Somastic covered pipe; when removed from stock caps were removed, interior of pipe inspected and temporary push plug inserted for transportation to site

of suitable length for the pulling of cable. Twenty-four of these were constructed to house normal joints. Six were larger to accommodate the by-passed stop joints, by means of which the pipe line could be divided into five separate gas chambers and the terminals isolated. Each manhole was provided with two brick entrance chimneys terminating in 30-in. diameter covers. The two chimneys allow cable feeding tubes to be installed so that cable could be pulled in either direction. These tubes have been redesigned so that future installations will require only one entrance.

To reduce the length of the manholes provision was made to move the steel pipe joint sleeves, about 9 ft. long, outside of the manhole during jointing. This was accomplished by installing galvanized iron corrugated culvert pipe, set concentric with the pipe line, in the ends of the manholes and inserting the joint sleeves in the culverts before building the manhole roof.

The pipe used was 7-in. O.D., 0.250-in. wall, electric-resistance welded steel pipe, furnished in double random lengths (40 to 44 ft.) and with bell and spigot ends. The inside surface of the pipe was coated at the factory with a polystyrene lacquer solution to prevent the formation of rust. To prevent the entrance of dirt during handling both ends of each length were closed with inside shoulder tin caps, spot welded in place. The bell and spigot joint was selected instead of the conventional welded butt joint, to insure that no "icicles" of weld metal would project into the pipe and because experience with chill rings showed that they had a tendency to warp.

Pipe Handling

The pipe was shipped to a railroad siding located at the midpoint of the line where a 3-acre tract of land was available as headquarters for the installing crew. Here the contractor cleaned the outside of each length of pipe with a shot blast, applied a hot priming coat of asphalt and extruded a ½-in. thick layer of Somastic on the external surface, leaving 8 in. at each end of the pipe bare to facilitate welding. Somastic is a mixture of 12 percent asphalt, 1 percent asbestos fibre, 63 percent sand and 24 percent limestone dust. In appearance it is similar to asphalt pavement.

As each length of pipe was removed from the stock pile the Somastic covering was examined, tin caps on the ends were removed and the interior inspected to insure that it was clean and dry. Pipe was then plugged and transported to the site of its installation on a six-wheel crane truck, with

*Engineer on Cable Practice, Electrical System.
†Cable Engineer, Underground Lines.
‡For Part I see "Electrical World," June 27, 1942.

a semi-trailer equipped with padded bunks for supporting the pipe.

Street crossings were made by tunneling, using a minimum number of cuts and dragging the pipe into place with the truck. In more complicated locations, such as the long railroad crossing or very wet trenches, lengths of pipe were welded together above the trench, welds tested, covered with Somastic and the completed length of line lowered into the trench and dragged into place. Removal of all stones or hard objects from the trench bottom was especially important during this operation to prevent injury to the Somastic.

PIPE TRANSPORTED to site on semi-trailer with padded bunks is lowered into trench using 8-in. wide sling of belting to protect Somastic coating

Bends were made with the Somastic in place before the pipe was taken to the site of its installation. The pipe was anchored to posts and bent to the required shape with a truck or tractor. Minor repairs to the Somastic were sometimes necessary when the hitches used were not properly padded, but it was possible to complete bends with radii as small as 25 ft. without major repairs.

Oxyacetylene welding was used exclusively. Roll welds were used wherever possible, as many as nineteen lengths of pipe being rolled at one time. Additional excavation was necessary when position welds were made. The open ends of installed pipe were kept sealed off with expanding type sewer test plugs at all times and, whenever work was not in progress, a 10-lb.-psi. nitrogen pressure was maintained to prevent the entrance of moisture.

As each section between manholes was completed the welds were given a 500-psi pneumatic test. Pipe was flushed to remove any moist air or condensed moisture. Oil and water were removed from the compressed air by passing it, under pressure, through a copper coil immersed in ice water, a glass wool pad and, after 1½ hours of preliminary flushing, through a dryer tube containing 3 lb. of anhydrous magnesium perchlorate. Flushing was continued until the air discharged from the opposite end of the pipe contained less than 0.06 grains of moisture per cubic foot. The discharge valve was then closed and the pressure built up to 500 psi. For testing the welds a sheet iron trough was placed around each joint, filled with sufficient water to cover the weld and the water examined for bubbles that would indicate a leak. If leaks were found the pressure was released, the leak repaired and the test repeated.

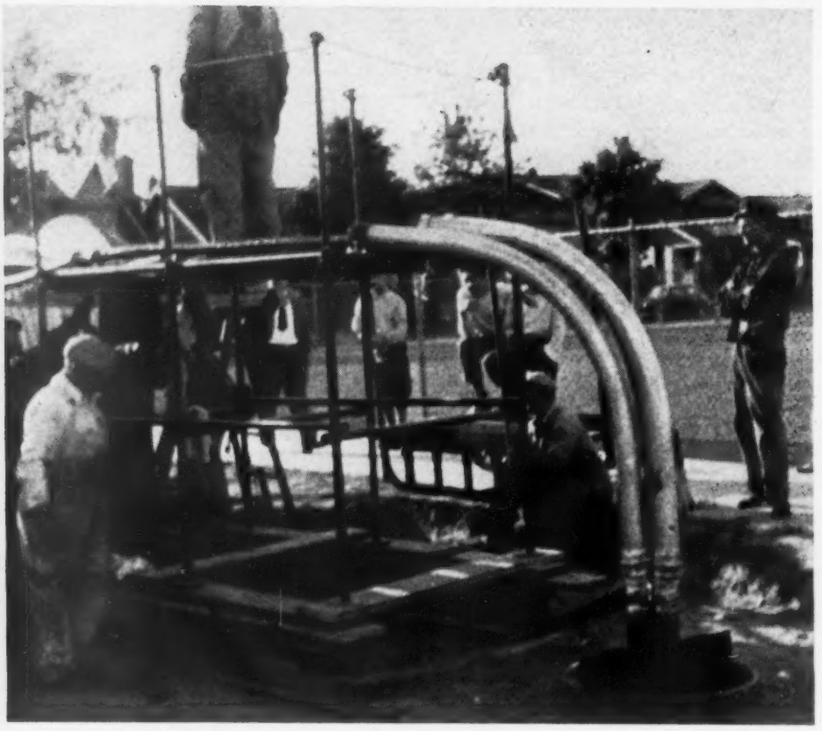
After testing, the joints were dried with a torch, thoroughly cleaned with a wire brush and an asphaltic primer applied. Joint molds were then fitted over the joints, filled with Somastic heated to 375 deg. F., in a heater mixer, and then closed, pressing the material over the joint to provide a continuous coating 1½ times the thickness used on the pipe.

Method of installing cable was similar to that usually used except for the stripping of the lead sheath, the larger feeding tubes and heavier equipment provided in case high pulling stresses were encountered. The lead sheath was left intact on the starting end of the cable for 12 ft., then stripped until the cable was nearly installed, and again left intact on the trailing end so that the cable projecting from the ends of the pipe, and from 2 to 4 ft. into the pipe, was covered. Lead gloves were bolted to the pipe ends and wiped to the sheaths to seal in the line during jointing.

Sheath stripping was done by

PIPE IS BENT with Somastic in place, using crane truck (left) Air compressor, ice bath and drier tubes used to supply air for 500-lb.-psi. pneumatic pipe test (right)

COMPLETED stepped pencil on normal joint



In pulling cable into pipe fresh knife cut is made in factory groove to facilitate removal of temporary sheath. Sheath is pulled from cable by hand and cable passes to tubes for feeding into pipe line

hand, one man on each reel made a fresh score in one of the factory grooves of the sheath with a knife and two men pulled the sheath from the cable as it passed, over their heads, between two platforms, before entering the feeding tubes. This method was so satisfactory that automatic strippers with their added pulling force would not be considered, and even the factory grooves in the sheath may be dispensed with on future installations.

The longest length of cable pulled was 1,490 ft. and the maximum pulling stress recorded for any length was 8,000 lb. No trouble was experienced in pulling lengths containing two 90-deg. bends. The shortest pulling time was one hour 20 minutes for 1,400 ft. of cable. Because of the low pulling stresses encountered a distance of 2,000 ft. between manholes has been proposed.

Skid Wire

Cable was equipped with a spiral copper skid wire. Space between turns of this wire was partially filled with petrolatum, which served both as a lubricant during pulling and retarded moisture absorption. The pick up of moisture by the cable during installation was negligible.

Normal joints were 8 ft., 9 in. long. A flush-type connector sweated on the conductors after removing the outler layer of strands provided a smooth conductor surface through the joint. The insulation was then stepped on each side of the connector. Paper was torn against a piano wire so that the edge of each layer was $\frac{1}{8}$ in. farther from the connector than the edge of the layer immediately beneath. The insulation was replaced layer by layer with butt wound tapes, identical to those removed, and torn at the ends exactly to butt against the torn edge of the factory tape. After the hand-applied insulation was built up to the diameter of the factory insulation 24 additional layers of 5-mil tape were added. This construction provided a joint with 20 percent more insulation than the cable and with a leakage path of 20 in. To prevent contamination of the exposed insulation during jointing splicers wore rubber gloves at all times and hot oil was poured over the exposed surface of the joint after each fifth layer of tape was applied. It required approximately 70 hours for two splicers and one helper to build a normal joint.

Stop joints were larger and more complex, but required fewer hours to complete in the field because of extensive factory fabrication. On the terminal side of each of the stop joints on the ends of the line the three conductors were brought out through a special trifurcating head and each conductor inclosed in a $3\frac{5}{8}$-in. O.D., 0.120-in. wall, copper pipe. Each of these pipes terminated in a barrier-type 138-kv. terminal adapted for use on gas-pressure cable by the addition of a bakelite "stop" tube. Space between the tube and the porcelain bushing was filled with oil at atmospheric pressure.

As the splicing progressed a 5-hp., 100-cu.ft. Stokes vacuum pump was connected to the pipe at a stop joint near the center of the line, and as each section between stop joints was completed the appropriate valves were opened until the entire line was being evacuated. Conductor heating was then started with a current 15 percent higher than the current rating of the cable, and evacuation and heating continued for eight days. During the greater part of this time the pressure in the pipe was less than 2 mm. of mercury absolute and the temperature of the cable between 42 C. and 44 C. The current circulating equipment was later used in tests conducted to determine the various impedances and resistances of the line.

All Utilities Share in Canadian War Effort

Public Utilities Wartime Workshop Board, made up of member companies of all utility associations, secures war work for tooling in machine shops in idle hours — Utilities serve as "sub-contractors" of major manufacturers

JAMES K. WILSON,* chairman Public Utilities Wartime Workshop Board

IN ITS first six months of operation the Public Utilities Wartime Workshop Board of Canada completed over 16,300 "bits and pieces"—machine and other parts, particularly those which tend to make "bottlenecks" in the munitions-producing industries—and has orders on hand for more than $300,000 of similar work.

"Bits and pieces" now being machined in the workshops of the public utilities of Canada—electrical, telephone, transportation and gas—include such parts as the following:

Armor plate, turrets and suspension units for tanks, marine engine cylinders, pump cylinders, eccentric sheaves and straps for marine engines, also large base studs, control valves for hydraulic presses used in munitions factories, 75-mm. armor-piercing shells, sleeves, couplings, valves, bushings, etc., naval gun mounting parts and sub-assemblies and radio sound locator parts in large numbers.

Wide Participation

The Public Utilities Wartime Workshop Board, as its name implies, is made up of the member companies in the five public utility associations in Canada: Bell Telephone Company of Canada, Canadian Electrical Association, Canadian Gas Association, Canadian Transit Association, Hydro-Electric Power Commission of Ontario.

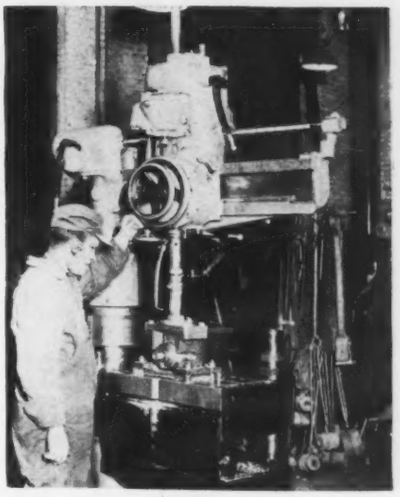
The board was formed in July, 1941, at the request of the Department of Munitions and Supply, in order to centralize the facilities of all the public utilities in Canada, as a furtherance of the Canadian war effort. As a plan of action, the board members believed the member companies of the various associations could help the Canadian Government in these three ways:

1. Training of military personnel in their maintenance workshops and garages for the Department of National Defense, in conjunction with the Wartime Bureau of Technical Personnel at Ottawa.

2. Manufacture of "bits and pieces," particularly those which tend to form bottlenecks in the Canadian munitions-producing industries.

3. Training of civilian personnel in their various workshops engaged in wartime activities.

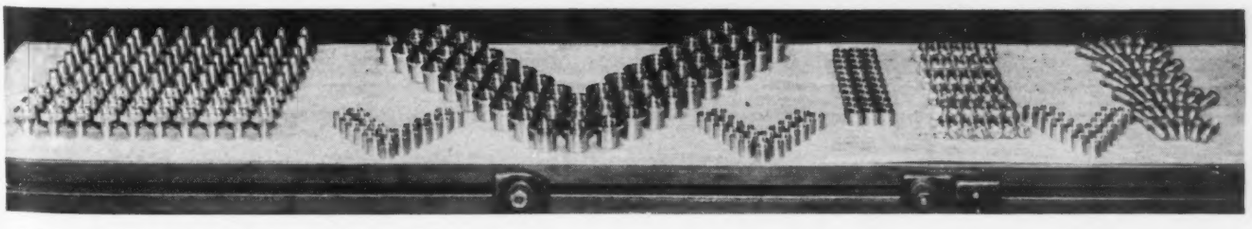
The larger companies gladly offered the facilities of their maintenance shops, garages and transportation systems for the training of military personnel. After several meetings with the Ordnance Corps, however, it was found that the Army could not take advantage of this offer at the present time, since orders from overseas drew out of technical schools and elsewhere all the people they had hoped to put in civilian plants for further training. This plan has been postponed for the time being.



DRILLING is being done on tank part

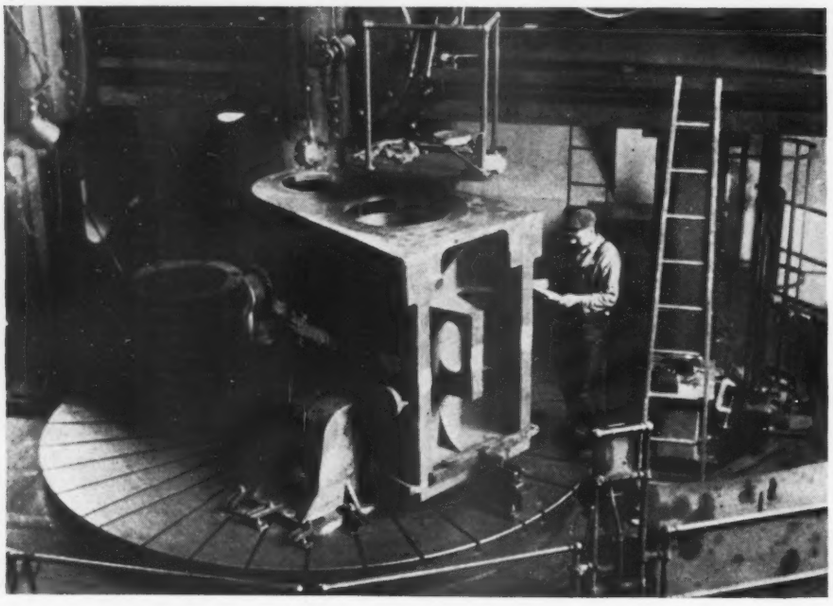
As a start on the "bits and pieces" program, a thorough survey was made of all equipment and facilities available in the maintenance shops of member companies of the associations forming the board.

With this information, appointed co-ordinators talked with the war in-



TYPICAL "BITS AND PIECES" work of Canadian utilities

A WORKMAN puts finishing touches on tank suspension parts



BORING OPERATIONS on marine engine cylinder

dustries and prime contractors, explaining to them the purposes of the board. Care was taken to point out that the utilities had no intention of competing with established manufacturers of machine parts. Rather, the co-ordinators stressed, they were entering into this plan of utilizing their machines and workshops during *idle* hours, for the sole purpose of assisting and increasing the production of material for war purposes.

Because of their favorable location, the Montreal Tramways Co. and the Shawinigan Water & Power Co. were first to secure orders from prime contractors, and their shops have since been running at capacity. The Toronto Transportation Commission, Hydro-Electric Power Commission of Ontario and Montreal Light, Heat & Power Consolidated followed closely.

Some of the larger utility companies knew about available facilities of privately owned machine shops—customers in their territory. At their request, work was secured by the board for these private shops. Thus, three of the larger shops in the Quebec area were given work for approximately fourteen months, having a value of at least $100,000. Again, several thousands of dollars worth of work has been distributed to privately owned shops in the Winnipeg area, through the activities of M. C. Gilman of the Winnipeg Electric Company, who is serving as chairman of a committee formed for distribution of wartime work in that territory.

Since the board was formed the Department of Munitions and Supply has organized a "Sub-Contract Division" with offices in Montreal, Toronto and Winnipeg, to handle the distribution of work for prime contractors to small machine shops throughout the country. Requests for work made to the board member companies by privately owned shops are now referred to this agency.

Realizing full well the slowing-up effect of a complexity of forms, the board kept to a minimum the number of records that must be kept to provide sufficient information for efficient control. Only two are necessary: Form No. 1 is a "war contracts and record of shipments"; Form No. 2 is a "war contract progress statement." One copy of each is mailed on the tenth of the month, covering the previous month's activities, to the board headquarters.

Operating Expenses Levied

While the board is a non-profit organization, it must pay operating expenses. To pay these, a pro-rata levy is assessed against all sub-contractors —companies contracting for the machine work. This is a fixed percentage of the invoiced value of the work done—at present 5 percent.

At the present time, and speaking generally, with all major war industries visited, it appears that there are more facilities available for doing work than there is suitable work available. This condition appears to exist for these reasons:

1. Scarcity of raw materials.
2. Shortage of certain key machines in prime contractors' plants.
3. More shops becoming available, because of restriction on production of domestic requirements; *i.e.*, depressed industries such as washing machines, vacuum cleaners, electrical appliance factories, etc.

The third aim of the board, that of training civilian personnel, is rapidly developing as a result of the "bits and pieces" program. In order to carry out the schedules of production, it has been necessary to increase the personnel of the various shops, which are now running two or three shifts.

Untrained men and students from technical schools have been taken on as apprentices and are being given training as machinists. Several of these men have already secured machinists' jobs as trained help in war industries.

Air-Cooled Transformers Solve Mine Power Problem

Reduced installation costs permit capacity in line with requirements — Result is more flexible operation and fewer shutdowns from accidental outages

*HUGH M. WOLFLIN,**
Idaho Maryland Mines Corp., Grass Valley, Calif.

INSTALLATION of three 150-kva air-cooled transformers at the end of an abandoned drift on a 2,400-ft. level of a gold mine

SECURING an adequate underground supply and distribution system has always been a problem for mine operators. Simplest and cheapest solution for small operations or development shafts of limited depth and low power requirement is compressed air or, more probably, a power cable from the surface carrying secondary voltage. But as depths increase and power requirements multiply, such cables become expensive due to their required size.

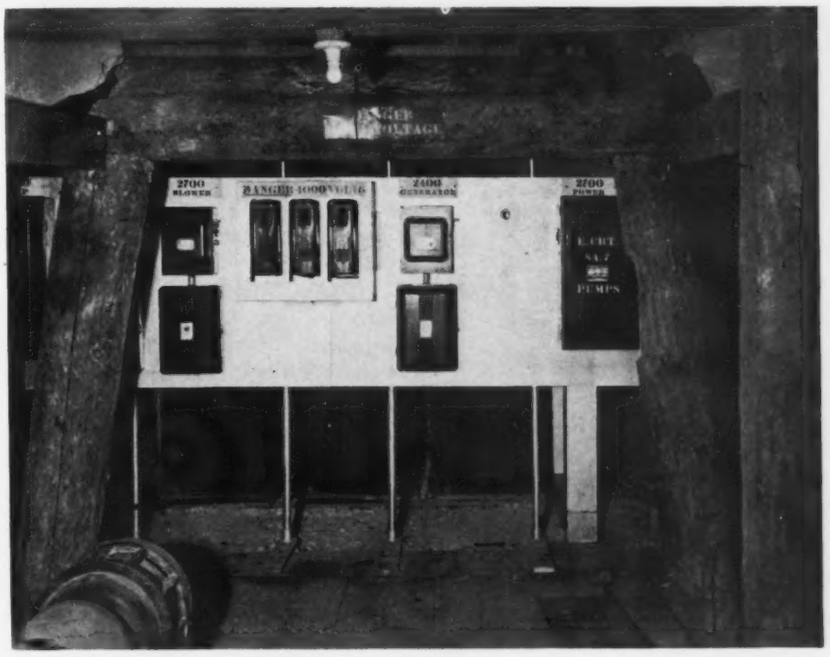
For deeper shafts with large underground power requirements high-voltage distribution invariably is used. Cable is smaller, voltage regulation better and losses less. Larger motors can be of the high voltage type, thus eliminating a portion of the underground transformer capacity required. Small pumps, blowers, tuggers, hoists and such units, however, are usually driven by low-voltage motors, for which transformers are needed.

Transformers of the air-cooled type seem to offer the most satisfactory solution to the problem of the underground substation and distribution system. An example is an installation at the Idaho Maryland Mine in Grass Valley, Calif. A careful study of operations indicated that this system would be less expensive and considerably more flexible than any other thus far devised.

In the gold mine a permanent substation includes a bank of Westinghouse air-cooled transformers. Also several smaller air-cooled units are used as semi-portable auxiliary power sources in various sections of the mine—places and locations in which air-driven equipment might have been used or where long secondary cable runs can be eliminated.

High voltage is always available at each level, so that the length of the small high-voltage cable required to supply the units is in general relatively short. The arrangement improves voltage regulation and lowers distribution losses. In addition, accidental outage of one substation shuts down a relatively small portion of the total mine load.

A saving in capital investment was realized by eliminating (1) excess substation transformer capacity for future requirements by mine expansion, and (2) the expense of providing a fireproof (concrete lined) vault with automatic fire doors and metal or concrete "catch basin" for oil-filled transformers. For non-flammable liquid-filled transformers the "catch basin" is needed, but not a fireproof vault. Such construction is necessitated to meet requirements of the Mine Safety Orders of the Industrial Accident Commission.



AIR-COOLED TRANSFORMERS placed at rear of switchboard simplified installation problems and reduced installation costs

*Assistant manager.

Flicker Reduction Affords Comparison of Alternatives

New radial feeds impossible — Step regulators functioned too frequently on compressor cycle — Series capacitor effective but failed — Closed loop offers the conclusive corrective

J. W. ANDERSON, Philadelphia Electric Company*

THIS is a story of expedient experimentation with voltage regulating equipment, confirming the conclusion that, in normal times at least, additional copper wire is frequently found to be the most satisfactory means of solving a distribution voltage problem, particularly when the new copper provides a parallel path for current flow.

The 4-kv. circuit in question supplies a high-grade rural area of some 25 square miles, with nearly 500,000 circuit-feet of three-phase and single-phase mains and branches, mainly No. 4 wire except for some No. 2, No. 2/0 open wire and No. 2/0 SS cable close to the substation. The circuit originally divided into two main branches about 9,000 ft. from the substation. The usual induction regulators are installed in the substation. Fig. 1 shows the backbone of the circuit in so far as it affects the situation to be discussed.

How It Started

The problem began with a proposed 200-hp. motor in the plant of a pressed steel company on the south branch of the circuit, about 30,000 ft. from the substation. The customer had been operating with a demand of about 140 kw., the largest portion of which was a 100-hp. motor on a hydraulic press, which he now intended to replace with one of double rating. Details of the proposed equipment and its method of operation were lacking.

A set of voltage charts was taken at various locations on the circuit and revealed conditions which had not appeared in previous routine checks. With the 100-hp. motor operating, load fluctuations of 15 to 20 amp. were accompanied by voltage dips of 4 to 7 volts (note that all voltages will be expressed in terms of the nominal 115-volt system standard), with base voltages as low as 105 at the tail of this circuit. In spite of these conditions not a single complaint had been received.

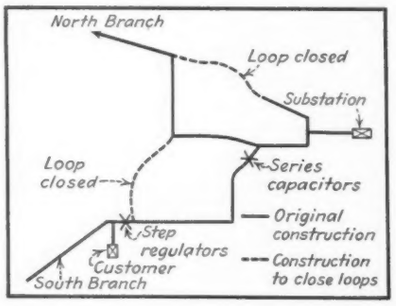


FIG. 1—Closing the loops with copper proved ultimate answer to a flicker problem

Thus a twofold problem was presented: First, improving the static regulation of the circuit and, second, improving its flicker regulation to the fullest practicable extent.

Four Alternatives

There appeared to be four alternatives for the permanent solution of the problem:

(a) Construction of 31,000 ft. of 33-kv. line and the installation of a 33/4-kv. unit substation adjacent to the customer's plant.

(b) Construction of the 33-kv. line referred to in (a), but with initial operation at 4 kv. (this line would begin at the 4-kv. distribution substation, which is also the source of the 4-kv. circuit supplying the customer, and thus could be used as a direct feed to him, thereby eliminating his load from the main circuit.

(c) Installation of additional copper in the distribution circuit to tie the north and south branches together, thereby providing loop feed to the customer.

(d) Installation of series capacitors.

Either of alternatives (a) and (b) were costly, both as to money and time of construction, and it was recognized (summer of 1941) that the material situation was becoming critical. Alternative (c) was practicable, used a relatively small amount of material, and unless right-of-way difficulties were encountered (as they later were) the construction period would be reasonably short. Alternative (d) appeared to have some possibilities, but the only series capacitors on the system were already operating in another division, and in addition, further investigation should be made before their installation could be seriously considered.

Voltage conditions being as they were, and with added load imminent, it was essential immediately to raise the voltage level at the tail of the circuit by decreasing the voltage spread. Step-voltage regulators were in stock and could be installed immediately. Consequently, a set of such regulators (100 amp., four 2½ percent steps) was installed just ahead of the customer and just beyond the point where one of the proposed loops of (c) above would close (Fig. 1).

Step Type Applied

It was recognized that the use of step regulators in this situation can be considered a misapplication of this

* Superintendent engineering division, transmission and distribution departments.

type of equipment, because of its inability to correct for voltage fluctuations. Rapid fluctuations within the time delay setting of the control will be transferred through the regulator directly; fluctuations of a longer period will cause the regulator to operate and actually increase over-all voltage regulation, and if such is the case, maintenance of the tap-changing mechanism will be high because of the abnormally large number of tap changes required in the course of a day. In spite of these objections, step regulators were installed as the only expedient immediately available to give the necessary improvement in voltage level.

Supplementary Regulation

Further decision was made to proceed with closing loops in the distribution circuit as outlined in (c) above, and also to release the set of series capacitors referred to in (d), for temporary experimental installation ahead of the step regulators, as a means both of providing some flicker correction not attainable with the step regulators and of supplementing the step regulators in reducing the circuit voltage spread.

Before proceeding further, it perhaps would be well to give some detail of the motor installation and its cycle of operation as determined by tests subsequent to its installation. It should be borne in mind that very little of this information could be obtained when the job was in the design stage.

Motor Cycling Duty

The motor itself is the squirrel-cage type, rated 200 hp., 440 volts, 435 r.p.m. It drives a three-stage high-pressure pump which charges the accumulator that maintains pressure on the steel press. The movement of the weighted piston in the accumulator controls a valve which admits water under pressure when necessary and at other times permits the pump to discharge into the main water storage tank. Thus the motor alternately idles and loads. The idling period is two to three and a half minutes, followed by load period of one to one and a half minutes. The frequency of this cycle is thus twelve to twenty per hour. The installation is started from standstill three times per day; 160 kva. of shunt condenser capacity was installed with the motor.

Recent tests give the following load and power factor data for the customer's entire installation:

	Kw.	P.F. (Lagging)	Kva.
Pump loaded	241.0	94.0%	256.5
Pump idling	81.5	77.6%	105.0
Standard 30-minute demand	130.0	87.0%	149.3

The starting operation of the motor produces current swings of 35 to 50 amp.; current changes of 15 to 20 amp. accompany the alternate idling and loading cycles. When the motor was first placed in operation the voltage dip accompanying starting was only about 10 volts and, because of its infrequency, was not considered a problem; the dip accompanying the idling-loading cycle was found initially to be 6 to 7 volts, about the same as anticipated on the basis of the meager information available prior to actual operation.

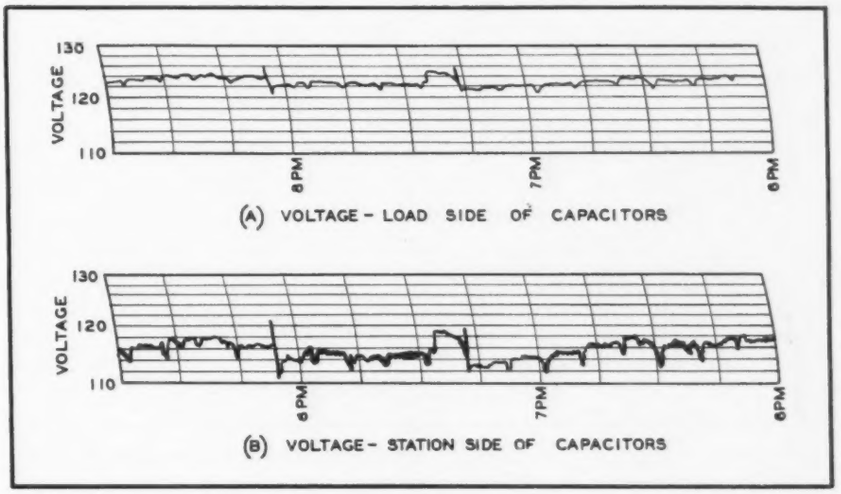


FIG. 2—Series capacitors lifted and flattened the voltages

Series Capacitor

Chronologically, significant dates are:

1941

June 20.....Step regulators placed in service
July 24.....200-hp. motor placed in service
August 7.....Series capacitors in service
August 18.....Series capacitors removed from service
November 2...Loops established in distribution circuit
November 28..Step regulators made non-automatic in neutral position, pending later removal.

The series capacitors proposed for temporary experimental installation are of the transformer-coupled type, each phase consisting of a 25-kva. fully insulated 2,400/240-120-volt transformer and a 15-kva., 2,300-volt shunt capacitor protected by a horn gap. The low-voltage winding of the transformer is connected in series with the line; the high-voltage winding is connected to the terminals of the capacitor. It was found in earlier studies that such a combination is cheaper than the more expensive lower voltage capacitors with elaborate protective devices connected directly in the line. The transformer is similar to the standard booster type and is operated lower than normal on the saturation curves, so as to minimize saturation of the iron in event of high currents through the capacitor. The horn gap is set to prevent saturation of the transformer and excessive voltage on the capacitor. Based on the manufacturer's recommendation as to the gap setting, it appears (and experience confirms) that the saturation characteristic of the transformer is usually the limiting factor.

These capacitor outfits were purchased on an experimental basis as 25-kva. units, each with a 15- and a 10-kva. capacitor, for flicker correction on an air-conditioning load that did not materialize. Later they were installed with only the 15-kva. capacitor for static regulation on a rural circuit in another division. Their performance was entirely satisfactory, but load conditions were not such as to give them conclusive tests. They were replaced with step regulators and thus made available for installation on the circuit supplying the 200-hp. motor.

They were installed accordingly in the south branch of the circuit, beyond the main fork (about 12,500 ft. from the substation), Fig. 1. The

estimated load on this branch, including, of course, the pressed steel company, matched the 65-amp. rating of the capacitor combination.

Capacitors Effective

The capacitors proved effective. The voltage on the load side of the capacitors was found by test to be 6 to 7 volts higher than the input voltage, with voltage levels at very satisfactory values (Fig. 2). Also, the flicker at this point in the circuit was reduced from two volts to one volt. With this improvement, it was questionable as to whether the step regulators near the customer should be continued, since the capacitors, in addition to the flicker relief, were now performing the function for which the regulators were installed, namely, that of improving general voltage levels. Further, as was anticipated, the regulators were actually increasing over-all voltage regulation beyond them. With conditions static, say, during the motor-idling period, a drop in voltage was experienced when the motor loaded, which lasted a sufficiently long time for the regulator to move a step to correct for the drop. When the motor idled again the voltage would rise above normal, and this step would have to cut out (Fig. 3). Thus over-all regulation beyond the regulators was as high as 9 volts.

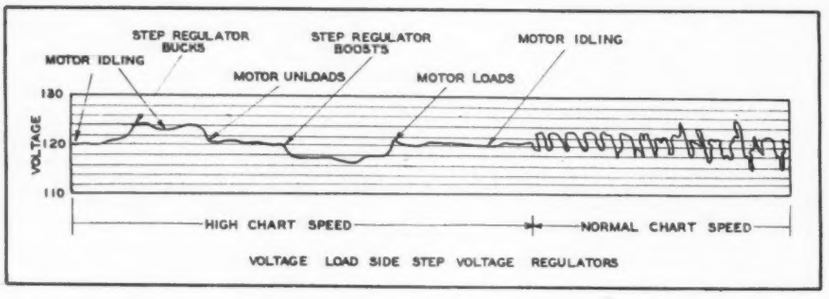


FIG. 3—Step regulators, a temporary expedient, lifted voltage level but increased overall voltage regulation beyond their location

Further, the regulators were operating about 600 steps per day. Actually, a second set of capacitors at the location of the step regulators would have been preferable to the regulators, and the original capacitor studies had made such a recommendation. However, only the one set was available, and in any event the capacitors were considered only a temporary experiment pending the closing of the loops in the distribution circuit, when, it appeared, such regulating facilities would be unnecessary.

Although effective in improving voltage regulation, the capacitors very quickly gave the variety of operating experiences for which any experimental installation is made. The 65-amp. nameplate meant just that and nothing more. Shortly after they were placed in service, arc-over of the protective gaps occurred on the heaviest loaded phase, flooding the local dispatch board with radio interference complaints—the only type of complaint received during the entire period (this experience indicates some question as to the relative importance of good voltage regulation and good radio reception). The capacitor in this phase had failed, and later all three phases were found to be open circuited. A bulged tank indicated overheating, and later examination showed the leads burned open inside the tank. The capacitor elements were not affected.

The actual load on the south branch of the circuit ran as high as 70 amp. when the motor loaded, with occasional swings to 75 or 80 amp. on the heaviest loaded phase, compared to the estimate of 65 amp. The saturation characteristic of the transformer is such that, on swings beyond 82 amp., voltage may build up without appreciable increase in current to the value for which the gap was set (approximately 150 percent of rating). Apparently some swings reached this critical value, causing successive gap breakdowns and repeated capacitor discharges, of sufficient current magnitude to burn the leads open.

The voltage rise through a series capacitor is proportional to the current through it and its reactance. Consequently, for maximum voltage rise, the capacitor must operate at or near full load and its kva. rating should be as small as possible to meet the given conditions. Any margin for contingencies, not inherent in the device, only results in reducing its effectiveness. It appears that the transformer-coupled series capacitor has very little inherent margin, and therefore must be applied conservatively, particularly where load swings or load growth are uncertain. Possibly in the case cited a combination of 460-volt capacitors connected directly in the line would have given more satisfactory results at comparable costs, if something less elaborate than the usual protective equipment were provided. In many instances, however, the transformer-coupled capacitor will be found economically justified.

It is true that any series capacitor installation must be tailor-made to fit the design conditions, and if possible these conditions should be determined by test, rather than by estimate. Extreme caution must be used when they are being applied to a growing distribution system or to any location where there is the possibility of a change in the design conditions. After installation, they must be carefully watched.

After the failure of the capacitors, it was necessary to keep the step regulators in operation—in spite of the severe operating conditions and the magnified voltage fluctuations beyond them—until the distribution loops were completed following prolonged right-of-way negotiations. The step regulators worked perfectly throughout the entire period and demonstrated conclusively their ability to take severe punishment.

Circuits Looped

Two sections of line construction totaling about 7,100 ft. provided three parallel paths for the motor current over a portion of the distance and two parallel paths beyond them practically all the remaining distance to the customer—in other words, a small network within the radial circuit (Fig. 1). As was expected, looping has provided a satisfactory answer to the problem, and the step regulators have been removed. Tests following completion of the loops indicated that the dip resulting from motor starting is now about 7 volts, and the fluctuation resulting from the idling-loading cycle is now generally about 3 volts, with an occasional

maximum of 4 volts. Minimum voltage at the tail of the circuit is slightly above minimum satisfactory values. Although authorities are not in complete agreement as to where a 3-to-4-volt fluctuation twelve to twenty times per hour lies with respect to the threshold of objection, experience indicates these values at such a frequency are not excessive. Consequently the case is closed until the customer decides to proceed with the 2,000-hp. forging plant he is now contemplating.

Motor Load No Help

Incidentally, it might be thought that the improvement in the customer's power factor as the motor loads would have considerable influence on the magnitude of the voltage fluctuations. As shown above, the idling power factor is 77.6 percent, whereas the loaded conditions give 94.0 percent power factor. Actually, however, this effect is negligible in so far as the distribution circuit is concerned. The relation between voltage drop and power factor depends on the ratio of resistance to reactance of the circuit; with No. 2/0 wire this ratio is such as to make the change in power factor quite effective; that is, the drop per ampere at 94 percent power factor is only about 83 percent of the drop at 77.6 percent power factor. However, with No. 4 wire, which is the ruling size between the first transformer and the customer, the drop per ampere is practically the same for both power factors. In this circuit the larger size wire is practically all in the feeder portion of the circuit, where changes in drop are taken care of by the substation regulators.

However, the change in power factor showed up very clearly in the improvement in voltage level by the series capacitors while they were in service. The effective voltage rise across the capacitor is proportional to the sine of the power-factor angle as well as to the line current. With the customer's load, in addition to other load on the circuit, a typical set of readings showed only a 16 percent increase in effective voltage rise with a 40 percent increase in current as the motor loaded. Actually the motor load alone would have resulted in a smaller rise at the higher power factor in spite of the increase in current.

Lighting a Giant Bomber Assembly Plant

Fluorescent lamps in porcelain-enameled reflectors mounted 40 ft. high assure uniform lighting on vertical surfaces and in space over 20 ft. above floor

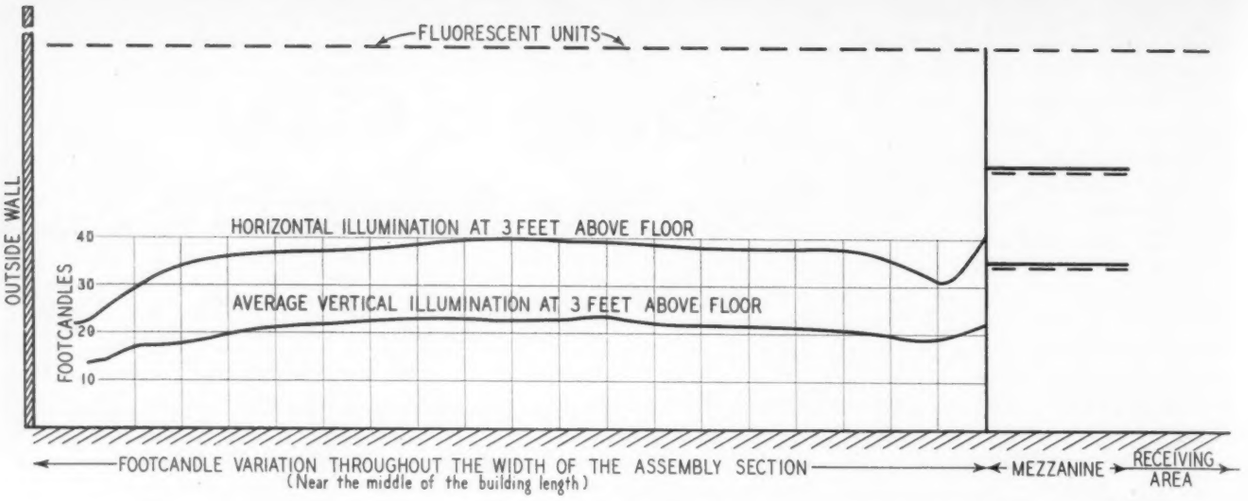
GEORGE J. TAYLOR, General Electric Company, Nela Park, Ohio

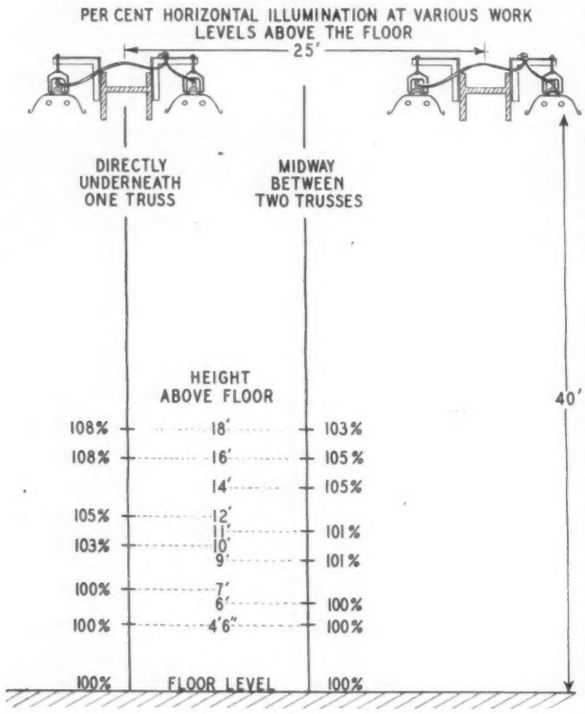
Austin Company, Engineers and Builders

AROUND 25 ft.-candles of uniform illumination is provided B-24 bomber assembly

SEVERAL REASONS determined the choice of fluorescent lighting for the enormous new plant in the Southwest where the Consolidated Aircraft Corporation is now producing B-24 bombers. First, the planes have large surfaces of shiny metal and diffuse light sources of relatively large area and low brightness provide comfortable seeing by minimizing reflected glare and sharp shadows. Too, employees working on plane assemblies frequently look upward—they would be momentarily blinded if light sources of high brightness were employed. Fluorescent lamps in porcelain-enameled reflectors also produce a widespread distribution of the light, which materially improves the illumination on vertical surfaces, an important plane of seeing in aircraft production.

From the utilization standpoint, diffuse distribution is not a disadvantage in such very large rooms even when the units are mounted at heights of 40 ft. or more, a service for which older lighting concepts called exclusively for high-bay concentrating types of reflectors. Lastly, work locations vary from a few inches above the floor to 20 ft. or more atop plane assemblies, and it had been previously proved that a well-designed fluorescent system provided essentially the same foot-candles at the floor level as at the higher working positions. This uniformity is important from the

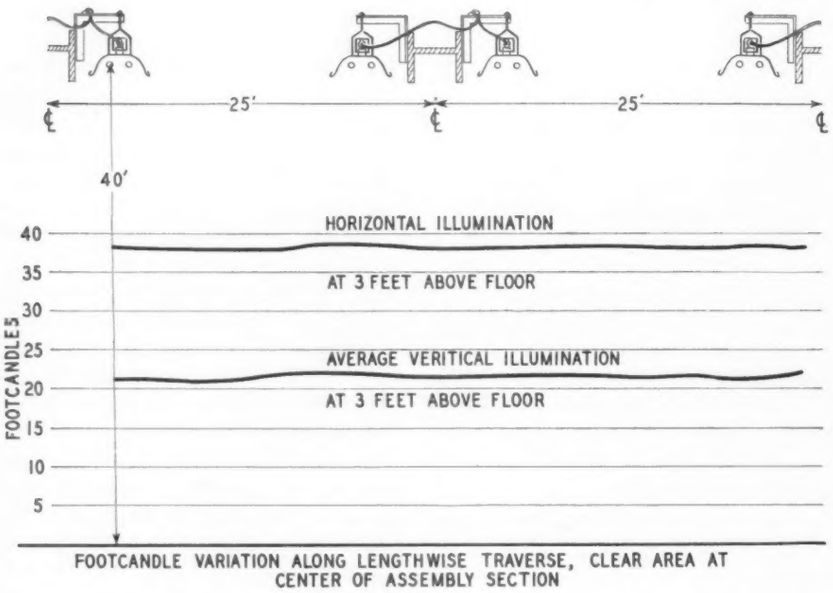




FOOT-CANDLE measurements in a clear portion of the assembly area show how uniform the illumination level is throughout that section. Note, too, that the average vertical illumination is more than half the horizontal illumination

READINGS at various heights also showed no significant variation in illumination with working planes up to 18 ft. above the floor, or the location with respect to the rows of fixtures, despite the 25-ft. spacing between twin rows of units

ILLUMINATION LEVEL is also uniform in the direction of the building length



FOOTCANDLE VARIATION ALONG LENGTHWISE TRAVERSE, CLEAR AREA AT CENTER OF ASSEMBLY SECTION

standpoint of shadows and brightness contrast. Certainly shadows would be more severe at the higher work levels under a system of smaller, high brightness light sources.

The lighting system consists of many thousand two-lamp RF (rectified fluorescent) units over the assembly, receiving and low mezzanine areas, with similar single-lamp units for the center mezzanine floor. In the assembly and receiving sections the fixtures are suspended in twin rows flush with the lower chord of the steel work by means of 2x2x¼-in. angle irons welded to the trusses. The mounting height from the floor is 40 ft. and the beams are on 25-ft. centers.

Intensity as Planned

Largest of the three sections is the assembly area, where the lighting fixtures are located on a nominal spacing of 8 ft. 4 in. along the truss. Since two rows of units are used per beam, the nominal spacing lengthwise of the building is 12 ft. 6 in. The average illumination level in service calculated for the empty assembly area was 36.5 ft.-candles. The wall and ceiling surfaces are light in color as a result of blanketing them with white fiberglas for air and sound conditioning.

A recent survey of the clear assembly area disclosed an average foot-candle level of 36.4, a very close check on the calculated value. The measurements were made when the lamps had burned over 1,500 hours on the average. An accompanying illustration shows that the illumination is quite uniform throughout the width of the assembly section, building up slightly near the mezzanine area, where additional units contribute some light. The same illustration shows the average vertical foot-candle level through-

out the assembly section width. Vertical illumination measurements were made in each of the four cardinal directions (north, east, south and west), the over-all average being 20.5 ft.-candles, more than half of the average horizontal illumination level. Vertical foot-candles were lower near the outside wall in the direction facing the wall for obvious reasons, and were higher near the mezzanine section in the direction facing the additional units located there.

To determine the foot-candle variations in the lengthwise direction, illumination measurements were also taken at ten stations, 5 ft. apart along a traverse at the center of the assembly section. The sketch indicates how uniform both the horizontal and average vertical illumination were found to be.

Utilize Reflection Factor

The extremely high vertical illumination level in the assembly section is partially due to the white cement used on the floor. The reflection factor of this cement, based on measurements at five locations, is 44 percent. Such a floor surface also enhances the general lighting efficiency by reflecting considerable light up on the underside of parts and planes on the production lines.

A test was also made of the illumination at various working levels above the floor of the main assembly area. It will be seen that there is no significant variation in horizontal foot-candles at working planes up to 18 ft. above the floor or at different locations with respect to the trusses, despite the 25-ft. spacing between twin rows of units. The reduced number of luminaires contributing to the illumination at the higher positions is approximately balanced by the increased foot-candles produced because those units are closer to the higher work planes.

The receiving section is lighted in a similar fashion and with approximately the same designed foot-candle level. The average of several readings taken in that area gave 36.2 horizontal foot-candles, with 17.4 on the vertical. The value of vertical illumination is lower than in the assembly section because (1) the receiving area is smaller and thus fewer units contribute to the illumination in those planes, and (2) standard light-gray cement having a reflection factor of 27.4 percent is employed.

By careful planning of the lighting-system wiring a saving of one-third the amount of copper was effected. Ten unit substations in the assembly area supply 440-volt, three-phase distribution for lighting and other power uses. The voltage to neutral of the lighting system network is thus 254 volts, reducing the current to the extent that No. 12 wire could be employed.

The length of runs averages 140 ft. to the load center.

• • •

Display Board Moves Obsolete Materials

Showmanship and good display technique are helping N. M. Wahl, Green Bay, Wis., storekeeper of Wisconsin Public Service Corporation, to move stocks of obsolete, non-standard, construction materials where in the past well-distributed lists and personal appeals to department heads have failed to bring results. "Orphan" items are set up on a display board in the storeroom, where line and maintenance foremen see them daily when drawing materials from stock. Result of this novel "point of sale" advertising has been lots of business where there was none before.

Wahl reasoned that even a trained foreman has difficulty visualizing from a typed list, the usefulness of items that were only slightly different, in some cases, from those he used daily. Even less does he remember, on the day of his need, some item he had decided to use when it was discussed with him weeks or months previously. Wahl's philosophy has been to "get it out where the man can see it, keep the stuff changing, to show that others are making use of the idea, and it should move."

First customer was a transformer and circuit breaker repair foreman who snatched five rolls of processed tape from its spot on the board, saying it was "Just what I needed. I never thought to ask for it as I figured it had been out of stock for years." To sustain interest in the board, when a slow mover "sells" it is taken from the board and a small American flag is spotted in its place for a day or two. Workmen almost always ask what "moved" as they observe the flag.

The "ORPHAN" BOARD
WE'RE ABLE AND WILLING — LOOKING FOR A JOB TO DO
DANGER HIGH VOLTAGE
USE THESE MATERIALS — INSTEAD OF ORDERING NEW

POINT of sale display of obsolete construction materials moves stock items where other methods fail

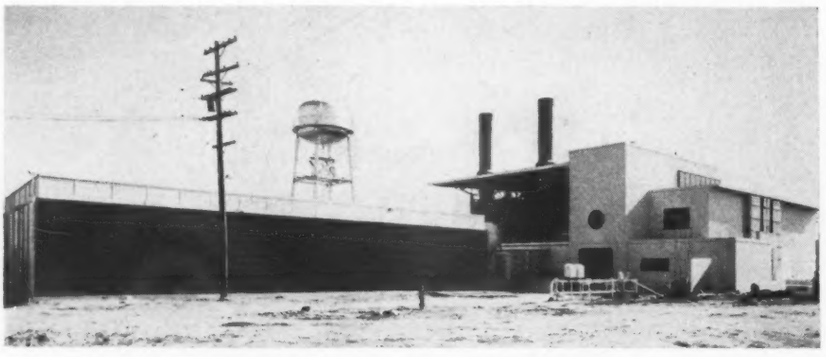
Outdoor Construction Reduces Steam Plant Investment Cost

Open-air turbine installation makes possible large saving in building costs and presents no operating difficulties — excess boiler standby pressure for accumulator action and quick pick-up

J. H. McCAMBRIDGE, Superintendent, Public Service Department, City of Burbank, Calif.

ANY fundamental changes in design must be accompanied by compensating advantages. In the case of the decision to build a semi-outdoor steam plant for the Burbank Public Service Department, including an open-air turbo-generator deck, the basic considerations were the possible savings in superstructure costs, the simplicity in structural design and the modern, streamlined appearance that could be achieved. There had been outdoor boiler plants (Utah Power & Light Company at Oren, Pacific Gas & Electric Company at Avon, Martinez and Oleum) and various outdoor hydro turbine installations, but Burbank and the adjacent community of Glendale were pioneering with open-air turbo-generators.

MODERN architectural simplicity features this new Burbank, Calif., steam plant, where one 10,000-kw. turbo-generator is installed outdoors, a second is under construction and a third on order; the special cantilever bridge gantry-type crane that will service all three generators is shown at right



INDUCED TYPE mechanical draft cooling towers with top-mounted fans serve the condensers; the semi-outdoor construction of the boilers is also shown

Building Costs Reduced

For the Burbank plant the saving in building costs averages $60,000 for each of the three units to be installed. This saving is derived by putting the turbo-generators on an outdoor deck and servicing all three with one special gantry type crane with a cantilever bridge. The crane operates from a track alongside the deck, with the bridge overhanging the turbines. The additional cost of this type of crane over a conventional overhead traveling crane is more than offset by the simplification of the structural features, since the building and foundations are entirely relieved of the crane load. This saving is considerable in such a region as southern California, where designs must allow for earthquake shocks of 0.1 to 0.2 gravity, or horizontal forces from one-fifth to one-half the vertical loads. The pleasing streamlined, modern appearance was achieved at no extra cost due to close cooperation between architect and engineers so as to obtain a truly functional design with the minimum expenditure.

Consideration was given to a complete outdoor plant during the initial design stage, but both appearance

and operating procedure finally dictated that the boiler section be roofed over and inclosed on three sides. The question has been raised in discussions about the plant as to whether outdoor operation presents any difficulties. It does not under ordinary circumstances. Maintenance work under adverse conditions might offer some problems. However, these would not be insurmountable, since it would be possible to erect a temporary covering over either turbine or generator. As a matter of fact, something of this nature was experienced during erection of the unit because the work was done during the winter months when the area had a record rainy season.

Capacity Needed

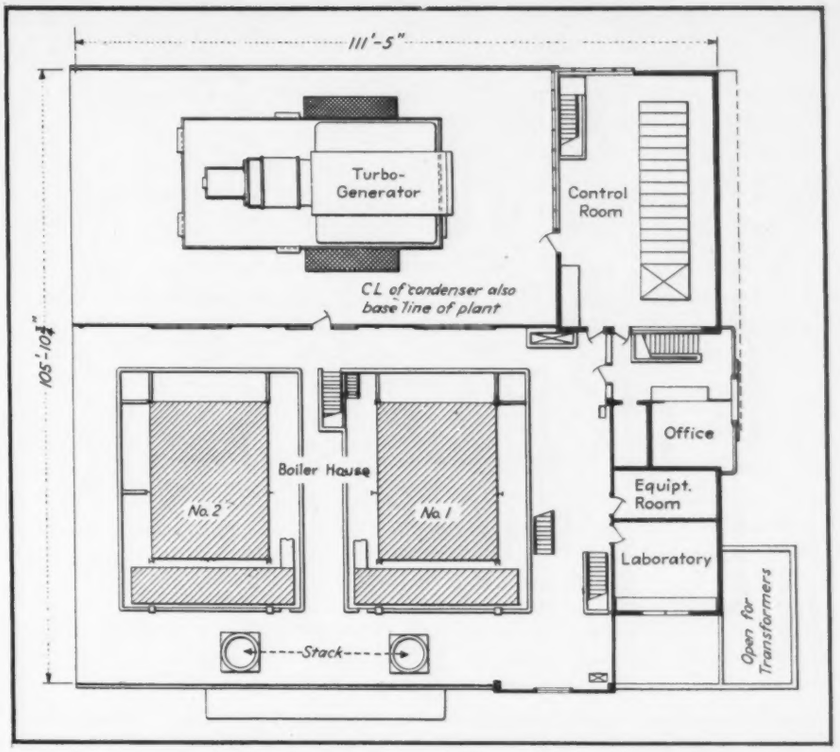
Plans for the plant materialized in 1939 when it began to be evident that the 5,000 kw. Burbank receives from Boulder Dam plus its purchases from the Los Angeles municipal system would be insufficient to meet growing war industry loads. It also was deemed essential to provide standby for the Boulder supply, since this power was subjected to all of the exigencies of a 275-mile, 287-kv. transmission line which traverses both mountain and desert country. The initial 10,000-kw. unit was ordered for maximum efficiency at 50 percent load, the idea being that this capacity would be ample to provide for both growth and standby for at least five years. However, shortly after the plant went into service in October, 1941, it has carried 10,000 kw. almost continuously and has at times carried 11,000 kw. Beginning March 15 the unit has been carrying 11,000 kw. 24 hours per day.

Two figures explain both this and the reason for ordering a second 10,000-kw. machine in 1940 and a third in 1942: Monthly system energy requirements have increased from 2,000,000 kw.-hr. in January, 1937, to 12,000,000 kw.-hr. in December, 1941, a 500 percent increase in four years.

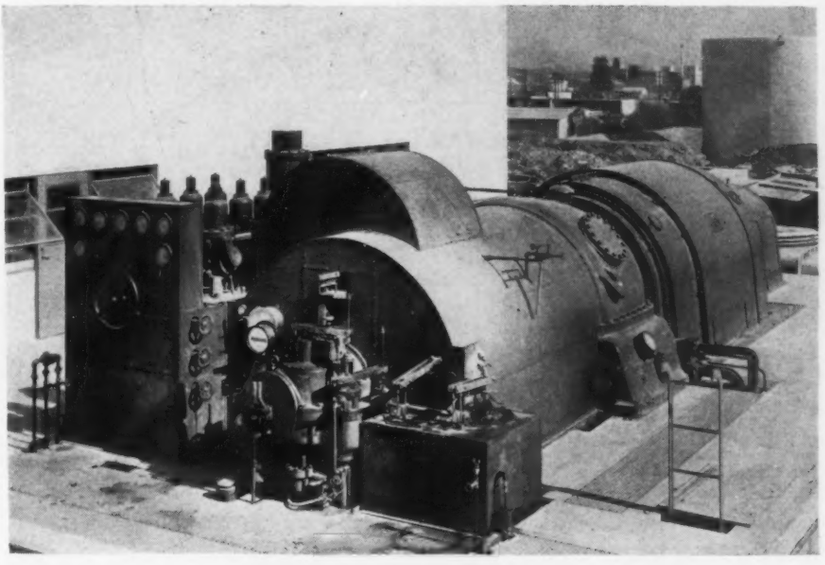
Factors of Design

Design characteristics were based on several considerations in construction and operation of the station:

1. Maximum economy under load consistent with reasonable initial cost.



PLAN of station shows how design facilitates expansion; plant will be extended to the left to accommodate units Nos. 2 and 3; gantry crane runs on a track which separates turbine deck from main switchyard



HOW turbo-generator looked before demountable housing was placed over the turbine section

2. Maximum speed in load pick-up from standby operation.

3. Maximum ease of operation, with emphasis on automatic control of vital functions.

4. Flexibility in design to permit future expansion.

5. Simplicity of design and layout, coupled with the most effective use of the available space.

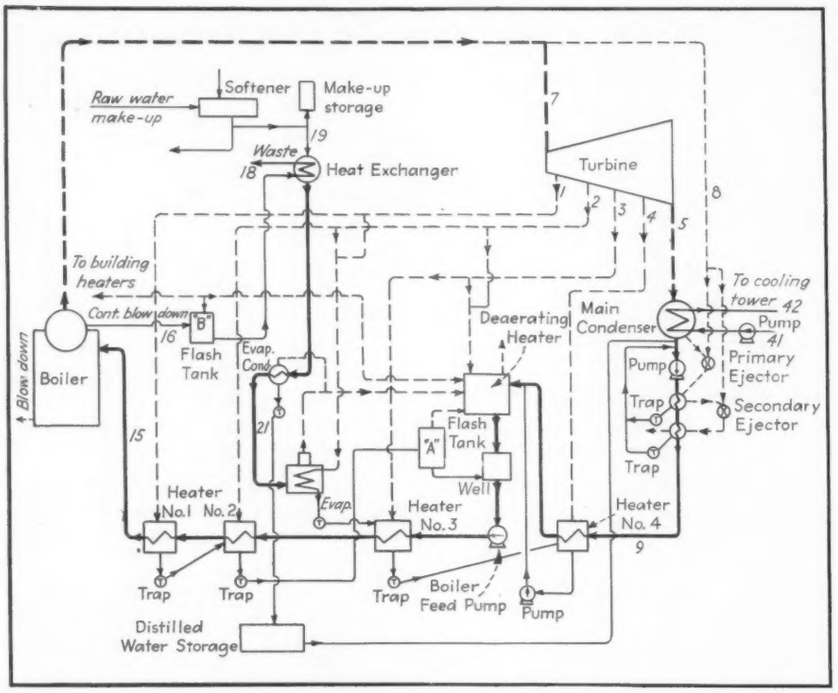
Each of these requirements has been met.

The main unit is a 12,500-kva., 0.8-p.f., three-phase, 60-cycle, 4,500-volt, 1,604-amp., 10,000-kw. Allis-Chalmers machine designed for 625-lb. steam pressure and superheat at 825 deg. The boiler installation consists of two Babcock & Wilcox 120,000-lb.-per-hour integral furnace type

steam generators equipped with tubular air heaters and mechanical combination oil and gas burners. Either fuel may be burned singly or in combination. Gas is brought into the station directly from the mains of the Southern California Gas Company. Fuel oil is stored in a 25,000-bbl. tank which is supplemented by three 10,000-gal. day service tanks and heated with tubular suction heaters using steam at 250 lb. pressure. Gas will be burned except in winter months.

Optimum Pressure

Steam pressure and temperature were selected after a careful analysis of steam turbine economy versus initial plant cost. One curve of power cost per kilowatt-hour at various pressures and superheats was plotted, along with a second for the same costs due to plant amortization only. Greatest economy as shown by the composite curve was for 625-lb., 825-deg. steam. Fortunately both figures are within the range allowable for carbon or carbon-moly steel for valves and piping. Priority difficulties would have been experienced if it had been necessary to use chrome-nickel alloys.



HEAT FLOW DIAGRAM shows arrangement of turbine auxiliaries and operation of regenerative cycle; five-stage extraction heating is employed

HEAT BALANCE AT FULL LOAD

(All values per kilowatt-hour at generator terminals)

Flow Line	No.	Pressure Psi. Abs.	Temp., Deg. F.	Weight, Lb.	Enthalpy	B.t.u.
Steam to turbine	7	640	825	10.22	1,421	14,523
Steam to air ejector	8	640	825	0.03	1,421	43
Extraction steam to heater	1	223	627	0.675	1,334	909
Extraction steam to heater	2	100	470	0.645	1,263	816
Extraction steam to heater	3	35	289	0.59	1,183	711
Extraction steam to heater	4	10	194	0.54	1,107	600
Exhaust to main condenser	5	2" Hg.	101.17	7.77	1,039	8,074
Extraction steam to evaporator	34	100	375	0.16	1,212	194
Condensate to F. W. heaters	9	...	104	7.80	72.6	567
Cooling water to condenser	41	...	78	500	46	23,000
Cooling water from condenser	42	...	93.1	500	61.08	30,537
Water fed to boilers	15	...	376	10.43	348.6	3,635
Make-up water to ht. exchanger	19	...	60	0.15	28	4
Make-up water to evaporator	21	...	172	0.15	140	21
Make-up vapor from evaporator	22	30	250	0.15	1,163	174
Boiler blow-down (continuous)	16	...	490	0.15	477	72
Boiler blow-down (continuous) waste	18	...	199	0.12	167	20
Boiler mud drum blow-down waste	..	...	490	0.03	477	15
Exit flue-gas loss (oil fuel)	..	...	...	....	...	2,080
Exit flue-gas loss (gas fuel)	..	...	...	....	...	2,210
Heat input to boiler in fuel oil	..	...	...	....	...	13,150
Heat input to boiler in fuel gas	..	...	...	....	...	13,280
Radiation losses from boiler	..	...	...	....	...	53
Radiation losses from auxiliaries and piping	..	...	...	....	...	48
Air ejector losses	..	...	...	....	...	13
Heat consumption of turbo-generator, including excitation, ventilation, windage, friction and all turbine radiation losses	..	...	...	....	...	10,950

Numbers in the second column refer to flow line numbers on the heat balance diagram.

Into Production Fast

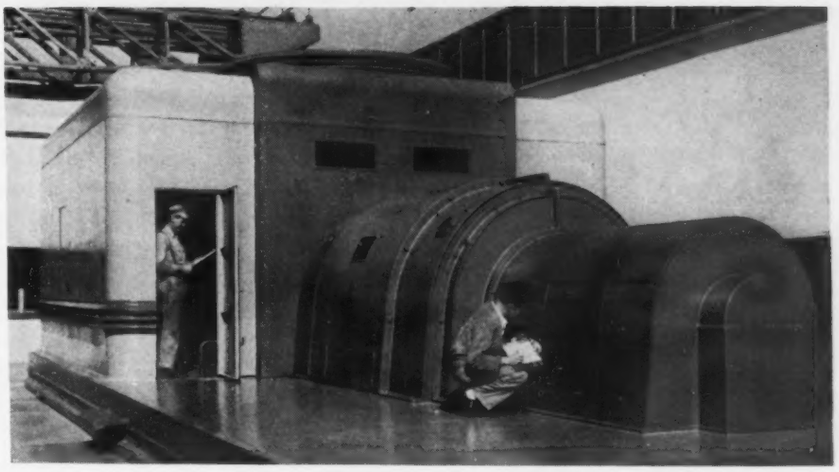
The quick load pick-up feature was deemed important because initially the unit was to serve principally for standby. Imposition of sudden load on the generator permits this quick pick-up through a system of pressure differentials which releases a small accumulator reserve in the boilers and at the same time actuates the automatic combustion control. The accumulator effect brought about by operating the boilers at a standby pressure approximately 150 lb. above turbine pressure at full rated load maintains sufficient steam pressure on the turbine inlet to operate the unit for 2.5 minutes while the combustion control system brings the furnace into line with steam requirements. Although manual control has been provided for feedwater, combustion and other vital functions for emergency purposes, under normal conditions the operator need not even so much as press a button for the plant to go from standby to full load under the controls afforded by the Bailey Meter system.

Automatic Controls

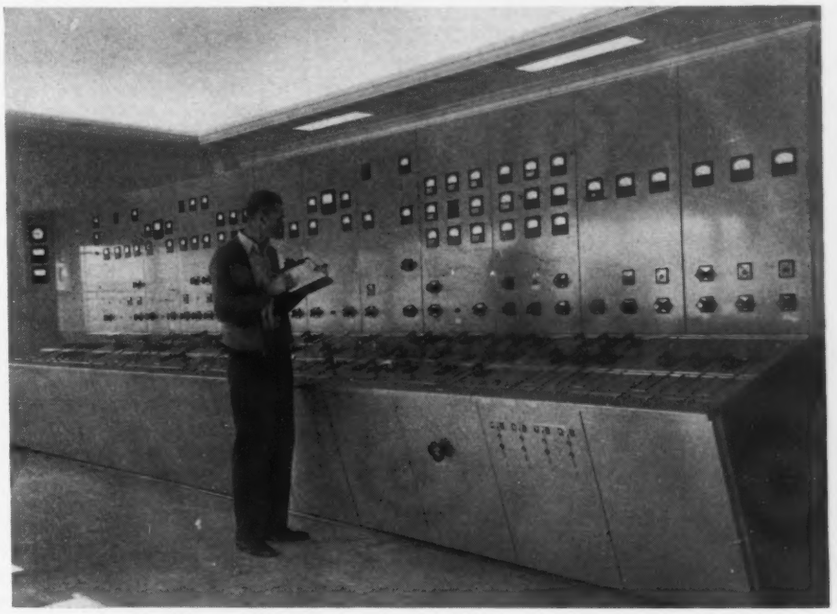
Mechanical draft also is controlled automatically. Both forced- and induced-draft fans are mounted on one shaft and are driven by one of two motors which are tandem mounted. A 75-hp. motor drives the fans until load reaches 5,000 kw. when a 300-hp. high-speed motor takes over, and the smaller slow-speed motor simply idles on the shaft. Fan inlet vanes operate from compressed air-drive units and the air pressure which actuates them also operates pressure relays controlling the motors. To avoid hunting in the middle load range the change from low to high takes place at a

point some 15 percent higher than the change from high to low.

Automatic starting has been applied to the 750-kw. house unit, the relay system being initiated by a drop in voltage on the station auxiliary power bus. All rotating auxiliary equipment is motor driven, with all motors up to and including 75 hp. rated at 480 volts, and everything above that capacity at 2,500 volts. Because the main unit feeds directly into the city distribution system at generator voltage — 4,500 — some study was given to using motors of that voltage on the larger auxiliaries. However, the increased cost because of the non-standard character of the motors precluded this selection. The 480-volt and 2,500-volt switchgear is located in separate rooms adjacent to the auxiliaries. The 2,500-volt equipment is metal-clad. The 2,500-volt station transformer is in the switchyard, with the 480-volt unit in a vault alongside the plant. The 480/240/120-volt transformers are air cooled. Tray distribution is used inside the plant for all cables and control circuits. Feeders and control circuits are carried from the plant under the crane track in duct to tunnels located beneath the adjacent switchyard. Tunnel construction is used to facilitate maintenance. In addition to breakers the leads between generator and switchrack are provided with surge protection consisting of Thyrite lightning arresters and capacitors.



MAIN turbo-generator is installed outdoors. It is an Allis-Chalmers 10,000-kw., three-phase, 60-cycle, 4,500-volt unit; the turbine is in the soundproofed demountable housing at the back; next is the generator, and the exciter is in the foreground



STATION and adjacent switchyard are controlled from this panelboard in the operating room overlooking the turbine; main illumination is from coves; relays mounted behind the board receive light from three fresnel units; the instruments are individually lighted from two small incandescent bulbs within each instrument

Connection With Boulder Dam

Burbank's Boulder Dam power is received at the adjacent switchyard, which is also the terminal for the tie with the Los Angeles municipal system. From there a 34.5-kv. loop line serves three transmission substations in the city. Also, the city distribution system is supplied through sixteen four-wire feeders from a 4.3-kv. switchrack located in the same switchyard. The 4.3-kv. switchrack is tied in with the 34.5-kv. rack through two transformer banks totaling 15,000 kva. Control and operation of these facilities have been incorporated in the control room of the steam plant, where the major operating functions for the whole system are now performed.

To date the station has successfully met all of the conditions for which it was designed. Operating economy using 1,060 B.t.u. natural gas and 125,000 B.t.u. per gal. refinery cracking residuum has been of the order of 13,800 B.t.u. per kilowatt-hour. Power costs, as might be expected with a modern steam plant located close to the load, are somewhat better than charges for Boulder Dam hydro power, which bears heavy transmission costs. The city pays the federal government 1.163 mills per kilowatt-hour for power at the Boulder switchboard. This is slightly less than fuel cost at the steam plant, operating on an average load factor of 50 percent. Operating and fixed charges will vary between 1.5 and 3 mills per kilowatt-hour, corresponding to load factors of 100 and 50 percent. Fixed charges are based on an investment of $95 per kilowatt for the first 10,000-kw. unit. The resultant power cost of approximately 4.5 mills per kilowatt-hour for 50 percent load factor is less than the present cost of purchased power.

The Burbank Public Service Department engineering staff, with J. B. Johnson, senior mechanical engineer, and Paul N. Crosby, senior electrical engineer, designed and supervised the construction of the plant, with the assistance of Carl A. Heinze, consulting electrical engineer, and D. A. Elliott, consulting architect.

Editorials

S. B. WILLIAMS, *Editor*

Utilities Lead Parade in Coal Supply Insurance

DURING the winter of 1917–18 it was a fuel shortage in the East brought on by a congested transportation situation that caused the major civilian discomfort, and it has been suggested that history might repeat itself this coming winter. If it does, however, it will find the electric utilities prepared.

This spring, when the coastal fuel transportation became so grave, all users of solid fuel were urged to lay in their stocks early and to lay in much larger supplies than they would ordinarily need. The figures at the end of May show the electric utilties for the country as a whole had done the best job of all large users. They had on hand a 96-day supply, whereas the coal gas retorts, the next highest, had but 71 days.

Normally at that time the electric utilities would have between one and two months supply on hand, but this year they will go into the winter months, if they continue to enlarge their stocks as they have since the first of the year, with enough to last until spring. In the critical areas the supply is even greater. In New England the supply in a year is up nearly 70 percent to 116 days, Michigan over 80 percent to 189 days and Lake Dock Territory nearly 200 percent to 158 days.

The hydro areas show the effect of a good first six months of water fall through a smaller coal supply, but still very substantially above their normal requirements.

July 4 a Working Day

INDUSTRIAL power requirements are now so large a proportion of the total central station sales that the weekly output chart prepared from data compiled by the Edison Electric Institute is probably the best general barometer of the over-all war production effort. As the conversion of civilian plants proceeds and the effect of limitations on civilian operations is stabilized we shall find this curve an even more accurate indicator of America's all-out war effort.

Particularly interesting is a comparison of the curve through July 4 for the past three years. Normally there are five big national holidays: New Year's Day, Independence Day, Labor Day, Thanksgiving and Christmas. When these fall during the week the effect is pronounced in the weekly output chart.

This year, however, the decline in kilowatt-hour output for the July 4 week was probably the smallest (percentage-wise) on record. Of course, coming on Saturday had something to do with it, but more can be attributed to the fact that the factories and men were asked by Donald Nelson to celebrate America's independence by turning out more materials for victory.

It is too bad, however, that this fine display of patriotism had to be marred by time off during the following week, as is indicated by the curve. The recovery of the week ended July 11 was the smallest (percentage-wise) of any week following Independence day. It leads one to the thought that the extra pay for working on a holiday was perhaps a more controlling factor than the patriotic desire to maintain production.

How Does Energy Flow?

HOW does electrical energy flow? To most practical people that would seem fairly simple—from a generator of higher potential through a wire to a consuming device of lower potential. But this is confusing energy flow with current flow. The two are not the same. The common waterpipe analogy is incomplete, and may be dangerously misguiding. It completely fails to reproduce the inductive action of one circuit upon another, so basic in the operation of power systems. Who ever heard of a waterpipe transformer?

Electric energy comes into being at the generating plants of a power system and is consumed at the various loads. By what paths does the energy flow from the sources to the loads? A scientist's viewpoint is given in a paper by Dr. Joseph Slepian before the recent A.I.E.E. convention on the VI energy postulate.

The scientist is entirely pragmatic in dealing with the question. He tries out various mathematical formulas involving current, voltage, electric field intensity, magnetic field intensities, etc., to see if he can find one which will check in every case with the observed energy generation and consumption. Then the dilemma arises, because he finds that there is not one but an infinite host of mathematical formulae for energy flow, which will check with the observed generation and consumption.

The scientist (and with him also the practical man) is forced to conclude that there is not just one single true energy flow formula, but that there are infinitely many, and that they are all equally valid and correct.

It is true that two of these many formulas are particularly simple, namely, the Poynting Vector and the VI postulate. It is also true that this last formula is par-

ticularly adapted for instrumentation on power systems through the wattmeter. This simplicity and convenience enjoyed by these particular formulas does not, however, make them any more true or valid than the other formulas. Therefore, we can attach significance to the answers given to many questions by these particular formulas only if the answers would be the same for all the many other equally valid energy flow postulates or formulas.

Fortunately, as Dr. Slepian brought out in his paper, the usual questions arising in the operation of a power system are such that all valid energy flow postulates will give the same answer. So the engineer may continue to use his wattmeters with confidence that the answer he gets will be correct and have unique meaning.

On the other hand, when different answers arise from the different energy flow postulates, as in some recent jurisdictional proceedings to determine whether interstate operations were involved, we have a dilemma of the first water on our hands. Will the FPC and the courts insist on adopting an answer that satisfies every day technical and commercial operations regardless of the fact that its validity cannot be proven to the satisfaction of the scientist, or can they be persuaded to postpone their decisions until the scientists find one that is valid?

Tubing for Condensers and Heaters

RESTRICTIONS on the use of copper alloys for tubing in condensers and closed feedwater heaters have raised new problems for engineers. Thin-walled tubing of iron or steel may have to be used for the duration of the war. Such iron-base tubing has been used abroad for these purposes and condensers have been offered by foreign builders with pure wrought iron tubing for fresh water service. Such tubing appears to work well on alkali waters, similar to those found in the Middle West. Both iron and steel tubes can easily be rolled into the tube sheets at both ends with the same means to provide for expansion as in the case of copper alloy tubing. Some alloy steel tubes have been used in heater services in this country.

Little data are available regarding the properties of such tubing, the sizes available, the most desirable finishes and its mechanical characteristics. A better knowledge of the coefficients of heat transfer in commercial service is greatly desired. Undoubtedly heating surfaces must be increased as compared with present practice with the copper alloy tubes, but the influence in actual use of film conditions, corrosion and other factors is little known. The effect of pure condensate which may have a low pH has also to be determined.

If such information is available abroad, little has appeared in current publications in this country. This information is now so urgently needed that any engineer possessing accurate data upon heat transfer or extended experience on the use of such tubing will do a real service to other members of the profession by making it available immediately.

Pride Goeth Before a Bumpy Kilowatt

POWER SYSTEM interconnections are being made and successive areas will be integrated so as to make reserves anywhere useful everywhere within reasonable distance. But there is no use in building new tie-lines unless they can be made to work smoothly. The kind that "bumps out" several times a week is worse than useless because it has wasted manpower and material and given little but false confidence in acquiring much needed generating capacity reserves.

There is far more to interconnection than drawing a black line on a map, getting the priorities and ordering the materials. Some lines have been built which did not carry the load or the reactive as they were intended to do. No such situations should be tolerated in these times of critical materials and critical demand for power. Engineers, the WPB and managements alike should be as sure as man can be, before going ahead, that the proposed links will tap otherwise idle reserves, that the combined system will be stable and that more hazards to continuity are eliminated by the new set-up than are introduced by it.

Fortunately, the electrical art has advanced to the point where such assurances can be given before commitments are made. Simulation on any of the several system calculating boards will tell how workable the proposed combination will be or what additional equipment or operating technique will make it workable. It is possible to compute the fault propensities, the breaker duties, the relaying and the lightning protection to attain any reasonably desired objective of interruption-free performance on a proposed line.

But that, even, is not all. It takes local operating and despatching skill in cooperation with the area despatcher to manipulate the respective elements of the interconnected systems so as to behave according to the computations. Anyone, no matter how thoroughly familiar with operating a local system but not familiar with the game of "snapping the whip," had better inquire what it may mean to be coupled to a chain of big brothers. In the electrical case the tail-end can start undulations clear back to the handle.

Those not familiar with the art of interconnected operations but confronted by its realities would do well to admit their limitations of experience and ask advice. There are consultants among the larger aggregations and among the manufacturers' engineers who have lived with these interconnection problems and developed the solutions over the past decade or two. They know all the implications, most of the pitfalls and most of the remedies. They know from correlated and digested experience just what can be accomplished safely and effectively by interconnection.

There may be some elements of pride that hold back local operators from admitting their deficiencies and asking for help. But this is war and war needs every bit of energy. Pride has been known to lose wars—kilowatts may win them.

Washington Comment

By GEORGE E. DOYING, Jr. Washington Correspondent

Can't Regulate Rates— OPA Intervenes in Cases

". . . NOTHING IN THIS ACT shall be construed to authorize the regulation of . . . (2) rates charged by any common carrier or other public utility."

So reads the Price Control Act of 1942. But the Office of Price Administration considers this to be a limitation only on its power to issue regulations applicable to utility rates. The agency does not consider that the language prevents OPA from undertaking to prevent utility rate increases wherever and whenever they may be proposed before state or federal regulatory bodies.

Not a Stopper

Just the contrary, in fact, is OPA's position! The price agency feels that the success of its general price policy of attempting to keep a lid on the cost of commodities and services generally "requires participation by this office in the field of public utility rates."

The words above quoted are the words of Harry R. Booth, former Federal Communications Commission rate counsel, who is now heading the newly established utilities division in OPA. Mr. Booth is serving under Dexter M. Keezer, assistant OPA administrator in charge of the Consumer Division. His office is comparable to an OPA transportation division which is taking the same path as Mr. Booth in fighting to upset increases in fares and charges by common carriers.

It's a little early yet to define exactly what OPA's policy regarding utility rates will be. But some insight to the agency's approach to the matter is available and it all adds up to the conclusion that to whatever other barriers utilities already have in the way of meeting increasing costs must now be added OPA's crusade to hold down the cost of living.

For instance, OPA takes the position that it has made, is making and will continue to make—to quote Mr. Booth again—"a substantial contribution to the stabilization of costs and expenses of operation of all types of utilities." Mr. Booth feels this in itself should eliminate, to a considerable extent, the need for any general rate increase in the utility field.

It is now clear, also, that OPA intends to oppose actively any attempt to increase rates as a means of offsetting increased federal corporate income and excess profits taxes. This is the issue in two of the instances in which OPA has already interested itself in utility rates and the agency has enunciated its policy in so many words—it feels that Congress intends that increased income and excess profits taxes levied to support the war effort should be borne by those upon whom they are assessed. In other words, heavier wartime corporation levies are intended to reduce profits.

But not War Taxes

"In adopting this policy," explains Mr. Booth, "we recognize that in peacetime, commissions and the courts have generally allowed federal income taxes as an operating expense before the determination of the income or return of a utility. However, a distinction may properly be made between such income and excess profits taxes levied normally and those levied because of the expense of conducting a war. We believe that any other policy, whether applicable to utilities or to industry generally, can only serve to bring about inflation and impair the basic efforts of OPA to stabilize the cost of living and commodity prices."

How far will OPA go—or be permitted to go—in opposing rate increases in the utility field? Future events will have to answer. OPA has been easing itself into both the transportation and the utility rate field cautiously and slowly, a step at a time.

Its first utility intervention occurred in a midwestern telephone case in which no state or federal agency had jurisdiction. OPA simply requested the company to confer with it, the company waived its legal rights and did confer, and subsequently withdrew the proposed increase which had been proposed as a tax offset. A step forward occurred when a member of the Pennsylvania commission invited OPA's view on a pending Philadelphia transit rate increase application.

Recently, on its own initiative, OPA petitioned the Maine commission for permission to intervene formally as a party at interest in the case of an electric utility asking to increase its wholesale rate in anticipation of higher taxes (ELECTRICAL WORLD, July 4, 1942, p. 7). What happens in this case may give a cue to other commissions and set the pace. Prior to OPA's petition to intervene, the state commission had suspended the proposed increase on its own motion, and no date has been set for a hearing, at which OPA's right to participate will come up for decision.

Regulation Transcended

Mr. Booth himself readily agrees that the established regulatory agencies have "the primary legal responsibility" for determining rate matters. "Our desire," he adds, "is only one of friendly cooperation toward them." The OPA utility chief's contention is simply that utility rates in a war economy have national aspects which transcend the ordinary regulatory processes.

He expects to have only a small staff—both the size and activity of this staff hinges somewhat upon how the congressional reduction in OPA's appropriation is absorbed internally. This staff will work mostly in the field, participating in rate increase cases to whatever degree permitted so as to make OPA's views felt as forcibly as possible. At least for the present, the OPA unit intends to obtain its supporting data and case material from the files of the commissions—it is planning neither a fact-finding staff of its own to solicit information from utilities nor a duplicating set of rate data.

NEWS OF THE WEEK

WPB Fixes Capacity Expansion for Duration

Utilities allowed 5,300,000 kw. of facilities, enough to carry through 1943: manufacturing space to be then devoted to marine program; utility orders with manufacturers at present amount to 9,600,000 kw.

The amount of additional generating capacity expansion for the duration of the war has been fixed by the War Production Board. Utilities are allocated 5,300,000 kilowatts of facilities which will virtually all be installed by the end of next year—after that, manufacturing space will be switched to marine output to meet the expanded naval and shipbuilding program.

1,830,000 Scheduled for This Year

Of the total, 1,830,000 kilowatts is scheduled to go into service in the last seven months of this year, from June 1. Next year's additions have been limited to 2,970,000 kilowatts, with a final 500,000 kilowatts listed for service early in 1944. Breakdown of the total discloses that 2,960,000 kilowatts are steam generation, 2,340,000 kilowatts hydro. While the division between steam and hydro by years is not disclosed it can be assumed that the ratio in any period is about the same, which means 1943 steam installations will run around 1,500,000 kilowatts.

Follows WPB Policy

This 5,300,000-kilowatt program has been carved out of the 9,600,000 kilowatts of generating capacity which utilities at present have on order with manufacturers for delivery through 1945. All 1945 orders and most 1944 orders have been "suspended," as has also a sizeable portion of machines ordered for delivery in 1943.

Determination of the limits of the "total war" power expansion program represents application to the utility industry of the War Production Board policy of virtually halting all construction of new plant facilities by next summer. (ELECTRICAL WORLD, May 30, page 126 and June 13, page 62.)

It is intended, now that the power expansion and plant expansion and conversion programs have been given definite limits, that further shifts in the war production program will be fitted into generating and plant capabilities of the nation's industrial system. In other words, in the power field, electric energy has been made a definitive factor and war production must be tailored to fit the cloth.

Only offset to this picture is the fact that the power division has retained the right to keep intact manufacturers inventories for about another half-million kilowatts of capacity upon which work has been halted. If within the next few months unforeseen war requirements indicate that a unit of generating capacity will be essential in this area or that, work can be re-started on some of these "frozen" jobs.

Utilities Were Consulted

WPB's power division has conferred directly with each utility involved in this drastic reduction in power plant expansion, necessitated by both the need to curtail use of critical materials in building new facilities and the need to convert the manufacturing facilities to marine production. Assignment of units has been made on the basis of the needs of reasonably unified areas rather than strictly by systems. Instructions directing the order of delivery of the allocated units from manufacturing shops is being prepared. Further, power division has worked out arrangements with other WPB divisions to insure that manufacturers will get materials to enable them to deliver the allocated units and all the auxiliary equipment strictly in accordance with "timetable" for generating expansion.

INSPECTION PARTY—Rear Admiral W. T. Cluverius and C. F. Hood, president of American Steel & Wire, (foreground) pause at a paper insulating machine during inspection of company's Electrical Cable Works, Worcester, Mass., incident to presentation of Navy "E" burgee recently

THIS WEEK'S NEWS BRIEFS

PORTLAND (ORE.) HOUSING AUTHORITY has been authorized to purchase locally 1,012 electric hot water heaters for installation in four projects now under construction. The new authorization will make possible the purchase of the heaters from the Fowler Manufacturing Co. in Portland, C. M. Gartrell, authority chairman, stated.

MORE THAN $500,000 has been invested in war bonds by 32 municipal and cooperative power systems, the Tennessee Valley Authority has reported. Memphis led the list with $49,987 worth of bonds, followed by Florence, Ala., with $49,950. The Duck River Electric Membership Corp., Shelbyville, Tenn., led the cooperatives with $37,000, and Alcorn County Electric Power Association, Corinth, Miss., ran second, with $25,000.

WIND AND LIGHTNING during a recent storm caused damage to the Mountain States Power Co. system near Kalispell, Mont., in some instances impairing service which required several days to repair. One large tree was blown over the line near the fish hatchery on the west shore of Flathead Lake, interrupting service for approximately 100 families south of that point.

RUBBER COLLECTION CONTEST between the Toledo Edison Co., Toledo, and the Community Traction Co., was won by Toledo Edison, with employees of the Edison company collecting 88,400 lbs. during the scrap rubber campaign, as compared with 81,156 lbs. by Traction company employees.

STREET LIGHTS WERE TURNED ON in Circleville, Ohio, on July 1, after the city had been darkness for six months. The lights had been ordered off as an economy measure on December 29. Columbus & Southern Ohio Electric Co. serves the city.

EIGHT WAYS THE WAR'S EFFECT on civilian life may help wage earners to save money were listed in a budget chart distributed recently to each employee of the Westinghouse Electric & Manufacturing Co. to stimulate 100 percent participation in the purchase of war savings bonds. The company's employees are now buying bonds at the rate of $350,000 a month. The pamphlet points out how such expenses as vacation trips and automobile driving costs will be lower this year because these "wartime luxuries" are necessarily restricted. By totaling these savings and subtracting the estimated tax increase, the worker can better determine just how much he can afford to lend Uncle Sam through the purchase of war bonds. Types of expenditures listed in the folder are automobile, clothing, vacation, Christmas, entertainment, household, installment purchases and other savings.

SWINGSHIFTERS IN MILWAUKEE snored more soundly last week as their windows broke out in a rash of posters

like this one, distributed by Allis-Chalmers Manufacturing Company with an eye to the health of its war workers.

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City Votes to Buy Frankfort Plant

Following unanimous approval by the city council of Frankfort, Ky., to purchase the local electric properties of the former Kentucky-Tennessee Light & Power Co., a board was appointed by Mayor C. T. Coleman to carry on the negotiations. The light and water plant are now held by the Tri-City Utilities Corp., which took them over when K-T was dissolved.

The Frankfort Utility Corp., originally formed to buy the plants for $1,300,000, recently allowed its option to expire.

Another Kentucky city, Paducah, which had started negotiations to purchase the properties of the Kentucky Utilities Co., adopted a resolution recently, authorizing the mayor to break off the negotiations. TVA officials recommended the action in order that they may have additional time for determining the value of the properties and acting as agent for the city in the transaction.

Government Accepts Engineers' Help

A movement to bring the specialized engineering talent of professional societies to bear on war production problems is moving cautiously from an unofficial acceptance to semi-official recognition, by governmental agencies, in Chicago. Direct manifestation of the movement is organization of a "joint" committee of all local professional engineering societies designated as the "Associated Defense Committee of Chicago Technical Societies."

Bringing Specialists Together

Conceived over a year ago by Robert C. Brown, Jr., Chicago attorney and vice president of the Physics Club of Chicago, the Associated Defense Committee of Chicago Technical Societies, under Brown's chairmanship, has for its professed purpose the bringing together of war production problems and engineering specialists who can solve them. Specialists assigned by the committee to special war production problems would work on a consultation basis with such governmental agencies as the National Inventors Council, Chicago Ordnance District, Board of Economic Warfare, WPB and others.

Concept of the Associated Defense Committee is characterized by Brown as "a manifestation of a known defect in our present war production set-up." In it he envisions an opportunity for engineers with specialized knowledge to answer for themselves the current question, "What can I do for the war effort?", by contributing their inventions, ideas and consulting services to lick production bottlenecks.

In the latter part of May, impetus was given the committee activities by the establishment of a Technical Development Section in the Chicago office of WPB and the appointment of Brown as consulting director of the section. By reason of the unique position he now holds as both chairman of the Associated Defense Committee and part-time consulting director of the local WPB technical section, Brown is now provided with the necessary authority to put production and other technical problems—of not too secret nature—directly up to local experts with experience to solve them.

Building Field Organization

Brown's efforts are currently being directed toward building up a national field organization of technical men to serve all government agencies in the war effort. Through such a national organization, called the National Associated Technical Committee, the opportunity is seen of offering specialized

engineering talent, and the product of inventive minds directly to the government through a network of local NATC groups, throughout the country.

Whether this organization will achieve the results that are hoped for it remains to be seen. Meanwhile the rest of the country is watching the activities of this Chicago group.

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Nisqually Development Showing Progress

Excavation work on the La Grande and Alder dams of the Tacoma Municipal Power System has been nearly completed, according to recent reports, and pouring concrete is expected to start on both projects in September. This second Nisqually power development is expected to produce approximately 90,000 kw. of additional power for the system by the end of 1943.

La Grande dam is located about 1¼ miles upstream from the present La Grande power house. It is concrete, gravity type dam, approximately 225 feet high and will have four 23x32 ft. radial spillway gates, to be furnished by the city. Estimated concrete amounts to 110,000 cu.yds. L. E. Dixon Co., Los Angeles, are the contractors.

The La Grande power house diversion tunnel will be approximately 6,400 ft. long; 14½ ft. in diameter and finished 17½ ft. diameter rough in rock. The penstocks will be of steel, with branches, about 400 ft. long. The surge tank will consist of a concrete shaft 40 ft. in diameter by 70 ft. high below ground; above ground it will be of steel construction 40 ft. in diameter by 45 ft. high. The new La Grande power house will house one 40,000 kw. vertical hydraulic turbine-generator unit. West Construction Co., Seattle, is the contractor.

Alder dam is about 1½ miles upstream from La Grande dam and just below the present diversion dam. It will be of concrete, arch-type construction and approximately 300 feet high. There will be a gravity abutment on the left wing with spillway and four radial gates. Estimated concrete is 440,000 cu.yd. and estimated excavation 180,000 cu.yd. The Alder dam penstocks, two in number, consist of two steel-lined tunnels through the dam. They are to be 11 ft. in diameter and about 200 ft. long. The power house at Alder will house two 25,000 kw. vertical hydraulic turbine-generator units together with a bridge crane. L. E. Dixon is the contractor.

Total cost of the development will be in the region of $14,000,000.

WPB Bans Further Priorities on Wiring

No existing structure not now wired for electric service can be wired during the war period if priorities are required, according to new ruling; maintenance also affected

WPB's Building Materials division has notified electrical contractors that priority assistance cannot be granted any longer for insulated wire and cable to wire buildings or parts of buildings which can get along for the duration of the war without electric service.

Farm Wiring Out, Too

In effect, the ruling means that no existing structure which is not now wired for electric service can be wired for service during the war period if priorities are required to obtain the materials. For instance, priorities will not be granted to wire an attic or playroom in a residence, nor to wire a farmhouse so that the farmer may tap the rural line already in place or being built to serve a war load.

The division also is refusing priority assistance for repair or maintenance of a residential lighting circuit where another lighting circuit is still functioning in the same house. Only exception to this rule is in instances where an actual fire hazard can be shown.

The division's policy was enunciated because of many PD-1A applications which fall outside these limitations. The division asserted its policy "must be observed because of the critical shortages which exist in copper, rubber and other materials entering into the manufacture of the wire." Specifications sharply reducing the rubber content of wire and cable insulation already are in effect (ELECTRICAL WORLD, April 4, page 73 and this issue, page 79).

Ratings for insulated wiring will be granted only for Army, Navy, Marine and Maritime Commission purposes, for munitions plants, for war housing when certified by the WPB Housing Division, for farm machinery in certain cases approved by the WPB and the Department of Agriculture, and for essential maintenance and repair to cure a fire hazard.

Courtesy The Christian Science Monitor

DIMOUT CONFEREES.—New England utility men were represented in this important conference at Boston called by Maj. Gen. Sherman Miles, U.S.A., commander First Corps Area, to study problem of lighting safeguards along coastal regions threatened by enemy actions. L. to r., J. M. Loughlin, regional director civilian defense for New England; Col. E. C. Webster, director Rhode Island council; J. W. Farley, executive director Massachusetts public safety; N. T. Williams, executive secretary New Hampshire council; Gen. Miles; Col. F. H. Farnham (New England Public Service Co.), director Maine defense council; Col. S. H. Fisher, director Connecticut council; Albert A. Cree (president Central Vermont Public Service) Vermont council

Kansas Utility Sale Approved by SEC

The SEC has approved the sale of the southeastern Kansas properties of the Kansas Utilities Co., a subsidiary of Community Light & Power Co., to the Continental Gas & Electric Corp. for $2,300,000. The properties will be transferred to Eastern Kansas Utilities, Inc., a subsidiary organized by Continental for this purpose. The purchase is part of a plan of United Power & Light, Continental's parent company, to comply with the geographic integration provisions of the SEC.

The properties involved adjoin the service area of Kansas City Power & Light Co., principal operating subsidiary of Continental and are interconnected with the facilities of that company at points in Miami and Linn counties. They consist of electric facilities serving approximately 10,000 customers in Allen, Anderson, Bourbon, Coffey, Linn, Miami, Neosho and Woodson counties. Continental will also acquire some non-utility properties of Kansas Utilities.

Eastern Kansas will finance the acquisition of the properties by the sale of $1,250,000 of common stock to Continental for $1,500,000 cash and the sale of $990,000 of first mortgage bonds to Northwestern Mutual Life Insurance Co. Kansas Utilities proposes to use the proceeds from the sale of its properties to redeem all its outstanding first mortgage bonds in the principal amount of $1,901,000, now owned by Community and for the payment of other obligations.

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Ease Electric Range Restrictions

Electric ranges which have been frozen in the hands of dealers since May 2 and those held by distributors and manufacturers which have a factory sales value of $80 and over may now be sold to the public under certain restrictions.

Supplementary Limitation Order L-23-B provides that anyone can purchase a new range in either of the "freed" classifications if he can certify to the dealer that (a) the new range is needed to replace one that is worn out, damaged beyond repair or destroyed, or (b) that no other cooking equipment is available, that the premises are wired and electric facilities installed for range operation. Dealers may also sell their stocks to fill orders of the Army, Navy, Maritime Commission or War Shipping Administration and any outstanding A-9 or higher ratings for ranges.

A TOWER AN HOUR—Using modern machine methods of erection, construction crews of the Los Angeles Bureau of Power and Light erected a tower an hour on the double-circuit 138-kv. line built to serve the new 196,000-kw. aluminum plant being erected in southern California by the Defense Plant Corp. There were 45 towers ranging from 110 to 130 ft. in height.

WPB estimates that the un-freeze order will release about 45,000 ranges for distribution where needed and that this stockpile will last about six months. After that, it is stated, the public will have to depend upon other types of ranges for cooking—gas and coal stoves have been curtailed but not stopped.

In addition to the 45,000 units released, manufacturers and distributors have another 25,000 units with factory values of less than $80. These are being reserved for installation in war housing projects remote from gas mains.

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Indiana Utility Loses Condemnation Decision

Application of the Public Service Co. of Indiana for a temporary injunction to prevent the city of Lebanon, Ind., from taking over the local electric distribution system has been denied by the Indiana Appellate Court. The petition was filed within a few hours after a judge in circuit court at Lebanon ruled that the city is entitled to immediate possession.

Lebanon officials say they will go ahead with plans already started to take over the system. Only lines and line equipment are involved in the condemnation proceedings, since no plant is located in the city. Electricity will be purchased by the city from the Public Service Co.

Community Plan Approved by SEC

The SEC has approved a voluntary plan for the complete reorganization of the Community Light & Power Co. system, in compliance with the "death sentence" provisions of the Holding Company Act, according to a recent announcement by the commission. The transaction calls for merger of Community with two of its subsidiaries, General Public Utilities Co., Inc., and Southwestern Public Service Co., with the latter company emerging as the surviving company.

New Southwestern Issue

Under the plan, the new Southwestern Public Service Co. would issue $18,500,000 of first mortgage and collateral trust bonds, due 1967 or 1972, with interest at 3½ to 4 percent, $5,500,000 in serial notes, and 85,000 shares of 6 or 6½ percent cumulative preferred stock, par value $100. Southwestern also will retire, for cash, all publicly held preferred stock and bonds of Community Light & Power and General Public Utilities.

A further step in the proposed plan provides for the acquisition by the new Southwestern company of three United Light & Power Co. subsidiaries, capable of physical interconnection. The three companies are the Panhandle Power & Light Co. in Texas, the Guyman Gas Co. and the Cimarron Utilities Co., both in Oklahoma, sale of which, for $7,250,000, was approved by the SEC in a separate order.

Other steps in the SEC-approved reorganization involve the elimination of the Texas-New Mexico Utilities Co.; recapitalization and partial liquidation of Gulf Public Service Co.; ultimate disposition of a Florida ice property of General and of the Kansas Utilities Co.

Must Dispose of Other Holdings

As an integral part of the plan, SEC stipulated that Southwestern divest itself of all control of properties it will own in East Central Texas after the merger and now owned by Gulf and Texas-New Mexico Utilities. The company must also dispose of its interest in Flagstaff Electric Light Co., Arizona Electric Power Co., Holbrook Light & Power Co., Southwestern Ice Co., Royal Palm Ice Co. and the Arkansas Utilities Co. The commission gave Southwestern one year to effect the dispositions.

A special meeting of common stock holders of Community Light & Power is scheduled to be held in Newark, N. J., Aug. 17, to consider the proposed merger.

June Stream Flow Conditions Much Improved

Flood conditions reported in Plains States and Northern New England; drought conditions along fringe of Atlantic seaboard; water conditions nationally much improved, however

Almost without exception, all major storage reservoirs used for irrigation and power contain more water than they did a year ago, according to the joint report for June of the Department of the Interior and the Dominion Water and Power Bureau of Canada, summarizing water resources and steam-flow conditions in North America.

The report records extensive and damaging floods in the Plains States from South Dakota to Oklahoma as well as in northern New England and southern Quebec. Only a few maximum flood stages of record were exceeded.

Drought Conditions

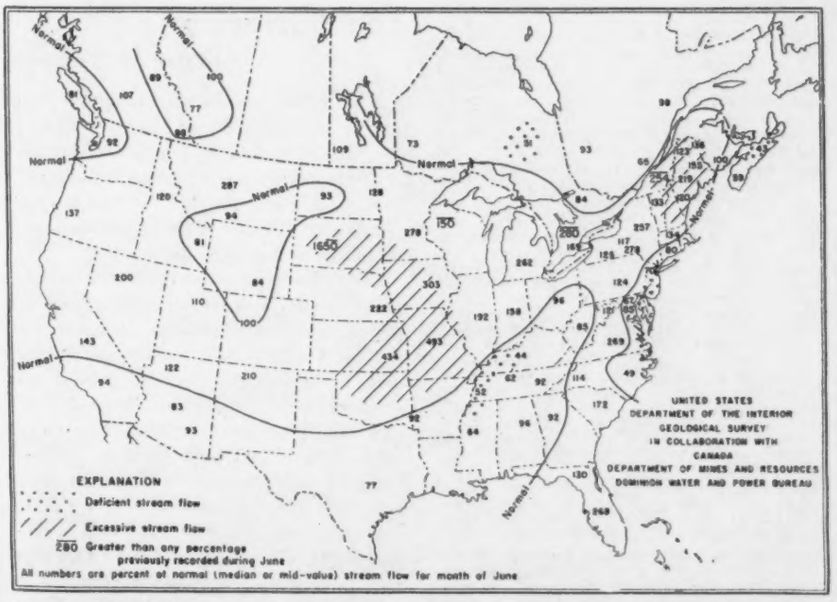
Drought conditions, on the other hand, continued in a narrow fringe along the Atlantic seaboard extending from Nova Scotia to North Carolina. Low ground-water levels at key wells in Connecticut, New Jersey, Pennsylvania, Maryland, Virginia and North Carolina, the report indicated, presage the probability of still lower levels during the late summer months and suggest that during the dry periods the flow of streams in these areas may quickly drop below normal. Drought continued in western Kentucky, western Tennessee and northern Mississippi. There were also continued deficiencies in precipitation in the southern intermountain and southern plains areas.

Stream flow conditions during June in Canada were generally normal except for floods on the St. Johns river in New Brunswick and the St. Francois river in southern Quebec. Some deficiencies were noted in other sections but the outlook for water conditions for both power and irrigation continues especially favorable, the survey said, throughout most of the United States and adjacent parts of Canada.

Areas of Deficient Stream Flow

Areas of deficient stream flow in general are confined to three localities: (1) A narrow strip along the Atlantic seaboard from Nova Scotia and Connecticut to North Carolina where the June stream flow averaged only 50 percent of normal in Nova Scotia and 65 percent from New Jersey to North Carolina. (2) The western part of Kentucky, Tennessee and Mississippi where drought has prevailed for some time as a remnant of an extensive drought condition that embraced nearly all the east. June stream flow in this area averages about 53 percent of normal. (3) Southern intermountain and southern high plains areas.

In the Atlantic coastal area groundwater levels and base flow of streams are low. Although present water conditions are not critical, the survey indicated, above-normal rains are needed to maintain supplies. Storage in the Tennessee Basin increased during June and the outlook for artificially sustained stream-flow available for power seems much better than last year.


Normal
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
IN COLLABORATION WITH
CANADA
DEPARTMENT OF MINES AND RESOURCES
DOMINION WATER AND POWER BUREAU
EXPLANATION
Deficient stream flow
Excessive stream flow
280 Greater than any percentage previously recorded during June
All numbers are percent of normal (median or mid-value) stream flow for month of June

JUNE STREAM FLOW CONDITIONS—Much improved stream flow conditions throughout the United States and adjacent parts of Canada are shown in the latest survey. Some damaging flood conditions are reported in some sections and drought conditions along a fringe of the Atlantic coast, but nationally, conditions are more nearly normal.

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WPB Tightens Curbs on Cable Rubber

All war agencies, including the Army, Navy and Maritime Commission, are now required to use the War Production Board specifications for insulated wire and cable, along with all nonmilitary users who have been limited to the wartime types since April. The move was ordered in a revision of Order M-15-b-1 which also makes some alterations tightening up the specifications previously in effect (ELECTRICAL WORLD, April 4, p. 73). Estimates are that the new program will save an additional 150 to 200 tons of crude rubber monthly.

The new specifications, generally speaking, reduce the amount of reclaimed rubber permitted in insulations. Type A insulation, for instance, may now contain only 10 percent reclaim, type B 15 percent, type C, 55 percent; in each instance the rubber content is unchanged. Jackets are allowed only 50 percent crude rubber, instead of 80 percent, but the reclaim allowance is increased from 35 to 75 percent. Cable, which was permitted 80 percent reclaim with no crude, now can have only 30 percent reclaim.

Jackets are disallowed in the new program for the three-conductor type POEJ-32 cord in heating pads and control switches.

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Bids on PUD Bonds

Whatcom County PUD, Bellingham, Wash., has under consideration an offer from Ballard & Hassett, Des Moines, Iowa, for the purchase of the district's $5,875,000 bond issue. It calls for issuance of $5,580,000 in revenue bonds and $380,000 in general obligation bonds—the limit the commissioners could issue without a vote of the people, making a total issue of $5,960,000, allowing $85,000 for the investment firm's discount.

Extension of Fuel Clauses Granted

Connecticut Light & Power Co. has filed with the Connecticut commission fuel clauses that will apply to certain gas and electric rates not now so protected, and withdrawing certain obsolete optional rates, according to C. L. Campbell, president. The basic rate will continue, he said.

President Campbell told an ELECTRICAL WORLD representative that so far as electric rates are concerned the proposed new schedule (effective June 27) extends existing sliding scale fuel clause applications from large power users to smaller power and commercial lighting service. Residential users of electrical energy are not affected by the proposed tariff changes. The commission has approved the schedule, stating that "if a utility company is to remain financially sound as a means of serving the public some recognition must be given to the increase in the cost of fuel as a major item of expense."

Makes for Flexible Economy

"As a general principle," declared the board, "the fuel adjustment clause points the way toward the solution of one of the most acute problems in the utility rate-making field, namely, that of integrating public utility rates, which are generally of a rigid nature, into a flexible national economy. The economic system of the country has been subjected in an increasing degree to strain by virtue of the tension occasioned by rigid public utility rates in a non-rigid general price situation. Anything that can now be done to bring utility rates more nearly into harmony with the general economic system is to that extent a public gain. It should mean a better balance in the economic system and a more effective operation of economic forces. Fuel adjustment clauses also bring about a reduction in customer payment during a period of falling prices in depression eras when customers are most in need of reducing their living expenses. Likewise the increase in price to a customer occurring in an upward swing of price levels takes place at a time when the ability of customer to pay, as measured in dollars, has in most instances moved upwards."

The fuel adjustment clause involved in these amendments to Connecticut Light & Power's electric rates establishes a base price for fuel of $4.75 a ton as a minimum and $5.25 as a maximum. The clause created by these amendments is designed not to increase the revenue of the company over that received in the base period, but to recoup the increased cost of fuel occurring since October, 1941. The estimated increase applicable to customers receiving service under wholesale commercial service and general power rates approximates $44,000 annually and affects 2,300 customers.

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FPC Authorizes Point Pleasant Sale

The Federal Power Commission has announced its order authorizing the sale of all the properties of the Point Pleasant Water & Light Co., Point Pleasant, W. Va., to the Appalachian Electric Power Co. for $379,000 in cash (ELECTRICAL WORLD, July 11, page 74).

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W. N. Matthews Dies

As Electrical World went to press, news was received in New York of the sudden death on July 19 of W. N. Matthews, president, W. N. Matthews Corp., St. Louis. He was 73 years of age.

In 1899 Mr. Matthews formed the partnership of W. N. Matthews and Brothers, with his brothers Leonard and Claude, to which the W. N. Matthews Corp. is the successor.

MEETINGS

Previously Listed

National Electrical Contractors Association—Annual convention, Bigwin Inn, Lake of Bays, Ontario, August 31-September 5. L. W. Davis, general manager, 420 Lexington Ave., New York, N. Y.

American Institute of Electrical Engineers—Pacific Coast convention, Hotel Vancouver, Vancouver, B. C., September 9-11. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

Pennsylvania Electric Association — Annual meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., September 11. A. B. Millar, managing director, State Street Bldg., Harrisburg, Pa.

Municipal Electric Utilities Association of New York State—Annual conference, Lake Placid, N. Y., September 16-18. H. E. Pearsall, secretary, 17 Whaley St., Freeport, N. Y.

International Association of Electrical Inspectors—Northwestern Section, Portland Hotel, Portland, Ore., September 17-18. F. D. Weber, secretary, P. O. Box 70, Portland, Ore. Southwestern Section, Fresno, Calif., September 21-23. H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western Section, Book-Cadillac Hotel, Detroit, Mich., October 5-7. F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern Section, Taft Hotel, New Haven, Conn., October 12-14. F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern Section, John Marshall Hotel, Richmond, Va., October, 19-21. C. M. Jones, secretary, 307 Trust Company of Georgia Bldg., Atlanta, Ga.

Illuminating Engineering Society—Annual convention, Hotel Jefferson, St. Louis, Mo., September 21-22. Frank G. Horton, executive secretary, 51 Madison Ave., New York, N. Y.

Association of Iron and Steel Engineers—Technical conference, William Penn Hotel, Pittsburgh, Pa., September 22-24. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Indiana Electric Association — Business meeting, Indiana War Memorial Bldg., Indianapolis, Ind., September 24-25. R. E. Blossom, secretary, 1414 Circle Tower, Indianapolis, Ind.

Arkansas Sells Its Water Systems

Contract for the sale of the Arkansas Power & Light Co.'s water plants in 20 cities and towns, to the Arkansas Municipal Water Co., an investment syndicate, was signed July 11, according to C. H. Moses, president of the utility. The price was about $3,000,000, Mr. Moses said. Application for approval of the sale by the state department of public utilities will be filed soon, it was indicated.

The water properties, which have about 24,000 customers, include nearly 300 miles of mains. Plants are located at Arkadelphia, Batesville, Brinkley, Camden, De Witt, Earle, El Dorado, England, Fordyce, Gurdon, Hamburg, Marion, McGehee, Morrilton, Newport, Parkin, Pine Bluff, Rison, Russellville and Wynne. Five of the towns have filed interventions to the anticipated applications and it is expected that more will follow suit.

In a formal statement, Mr. Moses said that the Arkansas Municipal Water Company is composed of representatives of Butcher, Sherred Co. of Philadelphia, Robert Hawkins Co. of Boston and investing associates. Headquarters for the new company will be established in Pine Bluff, Ark.

A recent decision of the Arkansas utilities commission denied the Arkansas Power & Light Co. authority to use the $187,500 it received from the city of Stuttgart, Ark., for the water system, toward financing its 1942 construction program.

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OPA Surveying Rate Increases

The OPA is making a nation-wide survey of requests by public utilities for rate increases with a view to opposing the proposed increases. Harry R. Booth, utilities counsel for the federal Office of Price Administration, announced in Chicago recently.

OPA, Booth conceded, does not have jurisdiction over utility rates, but he added, rate increases are contrary to the OPA efforts to prevent price inflation by holding prices of goods and services below the March level. He said the Northwestern Bell Telephone Company recently withdrew a petition for a 15 percent boost in rates in Iowa after the OPA protested.

Booth arrived in Chicago from Washington, D. C., to argue before the Illinois Commerce Commission recently in support of the request by OPA that the commission reduce Chicago's 8-cent street car fare to 7 cents, the level prior to April 20.

Output Curve Continues Upswing

Continuing the recovery registered the previous week, after a slight recession for the holiday period of July 4, figures on the production of electric energy for the week ended July 18 reached 3,565,367,000 kw., as compared with 3,428,916,000 kw. reported for the previous week. The figure for the latest week is 11.4 percent above that for the corresponding week in 1941—back at about the same level of increase registered throughout most of June. Figures are from the Edison Electric Institute.

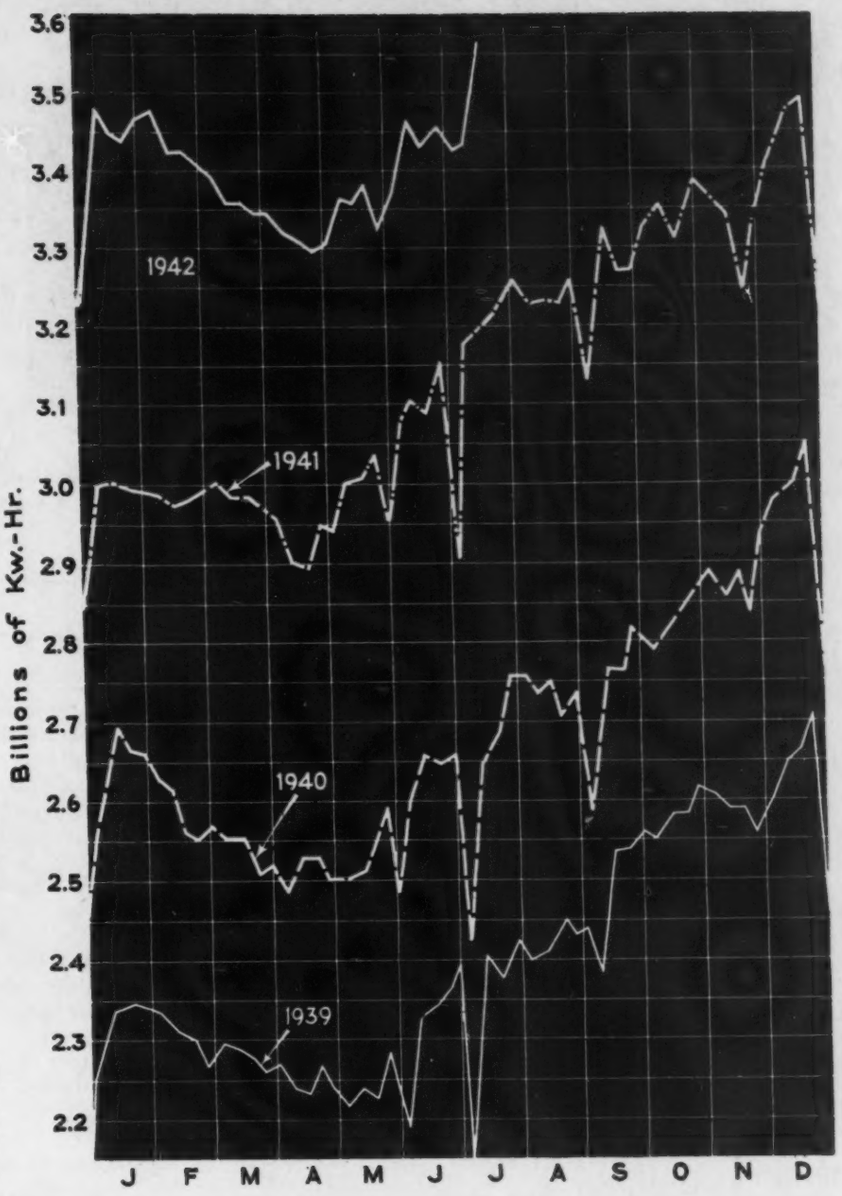
Biggest increases over last year's figures, among the seven major geographic regions of the country, are the Pacific Coast area which registered a 19.4 percent increase and the Southern States with an 18.5 percent gain. The West Central States with a 9.7 percent gain over last year also showed the biggest spurt in output for the week as the section increased its gain from a 2.9 increase recorded the week previous.

Weekly Output, Millions Kw.-Hr.

1942		1941		1940	
July 18	3,565	July 19	3,199	July 20	2,681
July 11	3,429	July 12	3,178	July 13	2,652
July 4	3,424	July 5	2,904	July 6	2,425
June 27	3,457	June 28	3,157	June 29	2,660
June 20	3,434	June 21	3,091	June 22	2,654
June 13	3,463	June 14	3,101	June 15	2,665
June 6	3,372	June 7	3,076	June 8	2,599
May 30	3,323	May 31	2,955	June 1	2,478
May 23	3,379	May 24	3,040	May 25	2,588
May 16	3,357	May 17	3,011	May 18	2,550

Percent Change from Previous Year

	Week Ending		
	July 18	July 11	July 4
New England	+ 4.3	+ 3.3	+17.3
Mid-Atlantic	+ 6.6	+ 3.6	+12.7
Central Industrial	+ 9.0	+ 4.1	+15.1
West Central	+ 9.7	+ 2.9	+13.3
Southern States	+18.5	+14.6	+25.5
Rocky Mountain	+ 6.1	+ 4.8	+10.4
Pacific Coast	+19.4	+18.5	+25.7
Total United States	+11.4	+7.9	+17.9



Electric Bills Tax Increase Avoided

The 1942 war tax bill as passed by the House carries a 45 percent corporate net income normal and surtax and a 90 percent excess profits levy but has no added special excise taxes upon electric utility services to consumers.

The current 3⅓ percent gross receipts tax on domestic and commercial bills (paid by the companies) remains in effect unchanged. The Ways and Means committee, before reporting the six-billion-dollar-plus revenue measure rejected a proposal to increase this levy to five percent and to make the tax applicable to publicly owned plants which are now exempt.

Senate hearings on the tax bill already have started. There is every expectation that the measure passed by the upper chamber will be considerably altered from the House version—with a likelihood that the final bill as it goes to the White House will be widely different from either.

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Establishes New Rate

New York Public Service Commission has granted Central New York Power Corp. permission to establish a wholesale rate for electricity applicable in the cities of Watertown, Ogdensburg, Utica, Little Falls, Rome and adjacent territory. The new rate will result in a reduction of about $11,000 in the company's revenue annually. The company proposes to transfer all the wholesale customers with special contracts to the new rate when the existing contracts expire.

Iowa Energizes Cedar Rapids Line

The new 115-kv. transmission line of the Iowa Electric Light & Power Co., extending between Cedar Rapids and Belle Plaine junction, was placed in service officially recently when President S. C. Dows closed the switch energizing the line, one of the highest voltage lines in the state.

The Iowa Commerce Commission has recently approved a franchise for a 30-mile extension of this line from the west line of Benton County across Tom County and into Marshalltown, Iowa.

Company has also taken bids for construction of a new multi-story addition to its steam-electric generating station in Boone, Iowa, to be used for expansion of boiler room and turbine department.

Slight Variations in Utility Securities

PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1934 1935 1936 1937 1938 1939 1940 1941 J F M A M J J A S O N D
1942

Prices of electric power and light securities varied only slightly during the past week. "Electrical World" stock index dropped to 18.2 from 18.3 the previous week: last year, 24.1. Bonds remained at 103.0; last year, 106.0

FINANCIAL BRIEFS

BROCKTON EDISON CO., Brockton, Mass., a subsidiary of Eastern Utilities Associates, has filed with the SEC a proposal for the issuance and sale of $1,900,000 of notes, series A, 3 percent, dated July 1, 1942, and due July 1, 1952. The notes are to be sold at not less than par. Proceeds are to be used as follows: $1,275,000 will be invested by Brockton in common stock of Montaup Electric Co., $460,000 will be applied to the payment of short-term bank loans and $165,000 to reimburse Brockton for funds previously used for capital additions. Montaup, in the same filing, proposed the issuance of 30,000 shares of its common stock to Blackstone Valley Gas & Electric Co. in payment of a $3,000,000 promissory note.

SEC HAS ISSUED a supplemental order extending the time in which Central States Power & Light Corp. may acquire by purchase more of its first mortgage and first lien gold bonds, 5½ percent series, due January 1, 1953, at 100 and accrued interest. Central States last year proposed to use approximately $5,300,000 for this purpose, the money to be obtained through sale of certain of its assets.

NEW ISSUES OF SECURITIES offered for cash in May amounted to $2,965,000,000 of which 95 percent, or $2,809,000,000, consisted of United States government obligations, the Securities and Exchange Commission reports. As during the preceding month, industrial issues, totaling $104,000,000, accounted for most of the corporate offerings. Flotations by public utility companies rose slightly to $21,000,000, but were still below the average for 1942 to date, and far below the 1941 average.

SEC SET July 23 as the closing date for receiving requests for a hearing on the proposal of International Utilities Corp. to pay out of capital or unearned surplus a regular quarterly dividend on its $3.50 prior preferred stock at the rate of 87½ cents a share on the 98,967 shares now outstanding. The amount of this dividend will be $86,596.

APPLICATIONS OF New England Gas & Electric Association and its subsidiaries, New Bedford Gas & Edison Light Co., for permission to effect certain transactions which require an order exempting them from the competitive-bidding requirements of Rule U-50 with respect to the sale of securities has been granted by the SEC. The transactions provided for the sale to two insurance companies of $1,000,000 principal amount serial notes, third series, 3 percent, due May 31, 1957, and the issuance of notes payable to bank in the aggregate of $2,000,000, all of which are to be issued prior to June 30, 1943, to mature June 30, 1945, and bearing interest at the rate of 2¼ percent a year.

Utility Reports

	Net Income 1942	1941
*California Electric Power and sub	$ 800,555	$ 591,248
*California Oregon Power	1,003,180	911,828
*Electric Power & Light and subs	8,172,236	5,756,859
*Iowa Electric	119,153	41,773
*Louisiana Power & Light	1,042,888	1,051,449
*Northern Indiana Public Service	2,412,273	2,836,588
*Oklahoma Gas & Electric	2,425,885	2,426,308
*Pacific Power & Light	644,990	958,834
†Pennsylvania Electric	1,933,738	2,073,750
*Southern Colorado Power	277,091	238,965
*Virginia Electric & Power	3,551,913	3,918,906

*Twelve months ended May 31.
†Twelve months ended March 31.

Bonneville-P.G.E. Negotiations End

Negotiations for a long-term contract for Bonneville power have been broken off by the Bonneville Power Authority and the Portland General Electric Co. following recent meetings in which negotiators failed to agree on a price for the company's properties in the event of passage of a Columbia River power bill, authorizing the government to take over private utilities.

Bonneville will continue to supply Portland General Electric with power on a day-to-day basis, as it has since December 1, when the old temporary contract expired. But Bonneville officials will make no commitment on the amount of power which may be made available over the increasing demands of war industries in the area.

Negotiations Fail

Negotiations broke down on the insistence of Dr. Paul Raver, Bonneville administrator, that an option on all properties, as well as immediate sale of facilities in two small districts already formed, be the price of a new power contract. It was not the option provision itself, but the inability of the several interested parties to agree on a price for the P.G.E. system which brought the final break in the negotiations, it was said. Trustees of Portland Electric Power Co., the parent company, would not agree to the authority's offer.

•

To Create Electro-Development Lab

A $500,000 electrodevelopment laboratory, where Bureau of Mines metallurgists plan to study the recovery and processing of minerals from the Pacific Northwest, with electrical energy from Bonneville and Grand Coulee dams, will be established in that region in the near future, according to an announcement by Dr. R. R. Sayers, director of the Bureau.

Upon completion, the new station will be known as the Northwest Electrodevelopment Laboratory and will be staffed by some 40 to 50 metallurgists and assistants. It will be equipped with electric furnaces, electrolytic cells of various types, ore-crushing and concentrating machinery, chemical laboratory and machine shop equipment and other installations needed in experimental work.

Operation will be in charge of Dr. R. S. Dean, assistant director of the Bureau of Mines, with headquarters in Washington, D. C.

HOW

DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Convert Regulators for Outdoor Service

By reconditioning 20-to-25-year-old indoor type regulators for outdoor operation, Oklahoma Gas & Electric Company has not only added many years to the equipment's life but has been able to pay a large part of the cost of reconditioning out of reduced insurance charges for outdoor units. The program has also avoided purchase of new equipment at a time when it would be difficult and expensive to obtain.

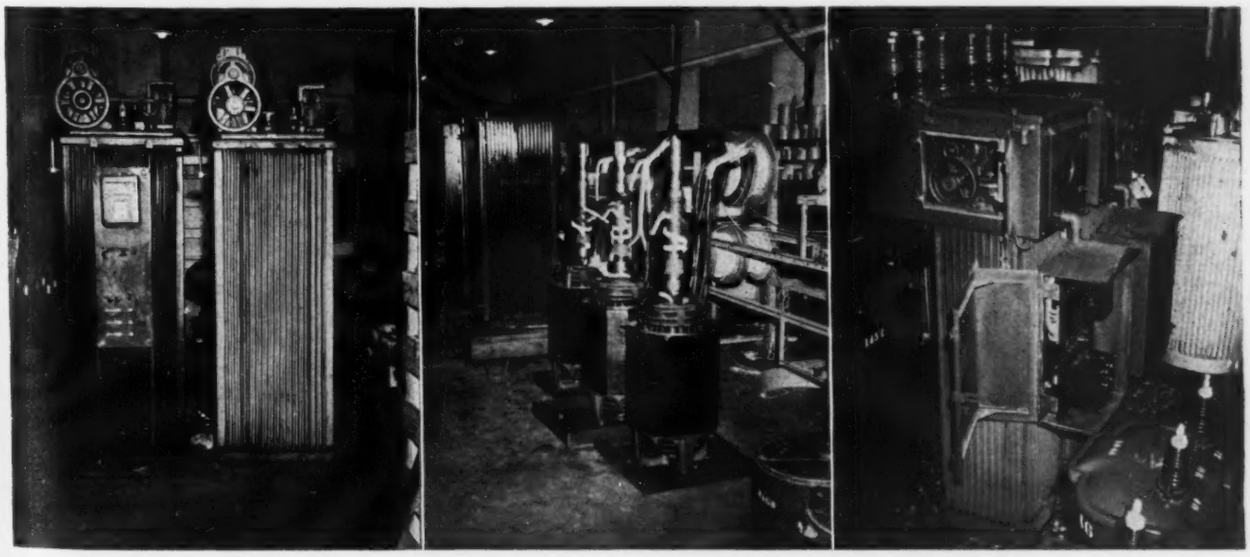
Aside from the addition of an internal instrument transformer, few changes were necessary in the internal design of the regulators except those dictated by the condition of insulation. Control apparatus in the older units, however, had been rendered obsolete by recent advances in design. Fortunately, however, modern regulator controls were relatively inexpensive and readily available as repair parts.

Control equipment was accordingly modernized by ordering a complete new regulator panel less the items from the old panel that were still usable. Control equipment most frequently replaced was compensators, contact-making voltmeters, motor contactors and hand controls. Position indicators of the dial type were almost universally added as they were not available on old units. With these changes reconditioned regulators were but slightly less efficient than new ones.

As shown, the regulators were completely disassembled and deteriorated insulation replaced on leads, clamps and ties. If rewinding was necessary coils were purchased from the manufacturer and installed. Bearings were checked and shafting aligned.

When electrical and mechanical repairs were completed on the first unit it was sent to a local sheet metal shop in Oklahoma City, together with an indication of desired rough over-all dimensions and clearances. Details of the weatherproof inclosure were worked on the spot with the sheet metal shop and reduced to a "standard." A cover was provided for the top and sides, with a window for the dial indicator and a door for necessary adjustments. A special weatherproof cabinet for controls was designed and provided with a door that exposed the front and one side of the compartment when full open.

Indoor paint was removed by strip-



THREE STAGES in the reconditioning of 20-year-old indoor regulators for outdoor service. Left, before disassembly the right-hand unit has had indoor paint stripped off. Center, with new leads on rotors and new weatherproof paint on tanks, units are in process of reconditioning. Right, completely reconditioned outdoor unit ready for installation. Note weatherproof housing for mechanism and control

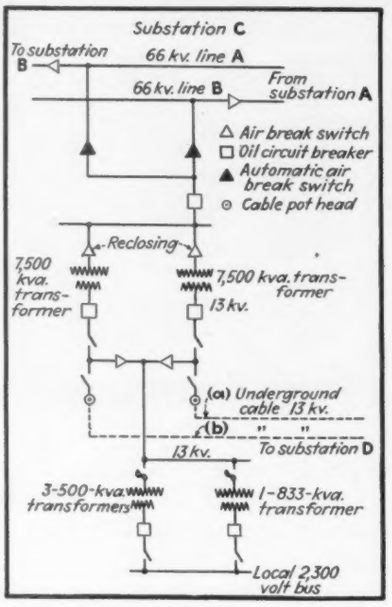
ping and weatherproof paint added to the completed unit.

•

Back-up Connection Safeguards Power

In an Eastern industrial community carrying a heavy load of war material production a 66-kv. tie serving as a back-up connection for an automatic substation of 15,000-kva. initial capacity has been installed to the great advantage of the service. In this scheme two 7,500-kva. transformers were installed to tie the existing 13-kv. facilities at this substation into the two 66-kv. through circuits shown in the diagram. The local neighborhood load was supplied through transformers aggregating 2,333 kva. serving a 2,300-volt bus. Two 13-kv. underground cables connected the substation (C) with another substation (D) in an industrial area about 2 miles away, and normally substation (C) was energized only by these two cables. Substation (D) was supplied from the general power system of the community, which in turn was tied into the transmission lines traversing the region, and of which the 66-kv. lines (A) and (B) formed a part.

In the system planning the installation of 15,000 kva. in transformer capacity at substation (C) was made in anticipation of load growth, but as this capacity was not immediately required, the set-up was arranged to provide for normally holding these transformers in reserve and off the line. In case of a voltage failure on both 13-kv. lines (a) and (b) from substation (D) the set-up provided instantaneous automatic connection of the 7,500-kva. transformers to the 66-kv. lines. The 13-kv. breakers then closed to energize the cables (a) and



ONE-LINE DIAGRAM showing arrangement of automatic selector air-break switches which were laid out to energize 13-kv. circuits by utilizing 66-kv. connection to 7,500-kva transformers in case of interruption of 13-kv. normal supply

(b) to substation (D) and also to pick up the local 2,300-volt load through the step-down transformers tied into the 13-kv. circuits at the bus tie center point shown. The usual protective relays were installed in addition to those needed for automatic operation. Present loads require parallel operation of all transformers and circuits, all four sources of supply being utilized to provide the capacity needed according to varying demands.

•

Joint Dipped in Solder Bath, Saves Solder

It has long been common practice for electric utilities to reclaim solder from old cable joint wipes by melting lead sheath and wipe together and then adding tin to bring the mixture up to the standard 60 lead, 40 tin mixture. But in the cable shop of one large utility they go this method one better.

The joints are cut from the cable. Each wipe is then held with tongs about half immersed in a molten solder bath. Having a lower melting point than the lead it surrounds, the solder of the wipe flows off the lead which is then removed. A small amount of the lead does get into the molten bath, but not enough to deteriorate the solder too greatly for use. The "soldermeter," a device like a hydrometer, shows the reclaimed mixture to run around 35 percent tin.

•

Transmission Costs at Various Voltages*

By C. A. POWEL
Manager Headquarters Engineering Department
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

In an accompanying table initial and operating costs are given for transmission of three-phase, 60-cycle power for a distance of 10 miles, at three nominal system voltages and with eight sizes of conductors.

The costs are based on a load of 10,000 kva. delivered at 80 percent power factor lagging for ten hours a day and followed by 2,500 kva. for fourteen hours a day.

Initial cost covers only the principal items of electric equipment, as of 1940. Transformers costs are for two 12,500-kva. banks, one bank at each end of the line. Cost of poles, right-of-way, buildings and real estate are not included because, for the voltages listed, these items will not have sufficient variation.

* Abstracted from advance pages of "Electrical Transmission and Distribution Reference Book."

VOLTAGE, KV.			CONDUCTORS						VOLTAGE DROP AT FULL LOAD			INITIAL COST						ANNUAL OPERATING COST			
						I^2R Loss															
Between Conductors	To Neutral	Amp. for 10,000 kva.	B & S or Cir.Mil	Total Weight Lb.	Resistance, ohms	10,000 Kva. Kv. for 10 hr.	10,000 Kva. Loss, $	2,500 Kva. Kv. for 14 hr.	Total Loss per year, Kw.-hr	Resistance IR, $	Reactance IX, $	Voltage Drop, $	Conductors, 1¢¢ lb.	Transformers 25,000 Kva.	Circuit Breakers	Lightning Arresters	Insulators	Total	Interest on Initial Cost, 6%	Depreciation on Initial Cost, 10%	I^2R Losses 1¢/kw.-hr.	Total
22	12.7	262	300,000	147,000	1.97	405	5.1	25	1,610,000	4.1	12.6	11.0	$26,500	$67,500	$4,200	$1,100	$1,200	$100,500	$6,030	$10,050	$16,100	$32,200
			No.000	82,100	3.50	720	9.0	45	2,860,000	7.2	13.4	14.0	14,800	67,500	4,200	1,100	1,200	88,800	5,330	8,880	28,600	42,800
			No.0	51,600	5.55	1,140	14.3	71	4,520,000	11.5	14.0	17.5	9,300	67,500	4,200	1,100	1,200	83,300	5,000	8,330	45,200	58,500
33	19.1	175	No.00	65,000	4.40	405	5.1	25	1,610,000	4.0	6.4	7.0	11,700	72,500	5,000	1,700	1,800	92,700	5,560	9,270	16,100	30,900
			No.2	32,500	8.82	810	10.1	51	3,220,000	8.1	6.8	10.5	5,850	72,500	5,000	1,700	1,800	86,800	5,210	8,680	32,200	46,100
			No.4	20,200	14.0	1,290	16.1	81	5,120,000	12.9	7.0	14.5	3,600	72,500	5,000	1,700	1,800	84,600	5,080	8,460	51,200	64,700
44	25.4	131	No.2	32,500	8.82	453	5.7	28	1,800,000	4.5	3.8	5.9	5,850	76,200	5,750	2,200	2,400	92,400	5,540	9,240	18,000	32,800
			No.5	16,000	17.7	910	11.4	57	3,610,000	9.1	4.0	9.7	2,900	76,200	5,750	2,200	2,400	89,400	5,360	8,940	36,100	50,400

Costs for Transmitting Power at Three Voltages and With Eight Sizes of Conductors
(Distance, 10 miles. System, three-phase, 60-cycle. Load, 10,000 kva., 0.80 p.f. lagging for ten hours and 2,500 kva. for fourteen hours)

A Natural for War-plant Lighting

THE NEW 4-LAMP BALLAST

Operates four 100-watt fluorescent lamps, yet costs no more than a Tulamp 100-watt ballast.

Reduces copper requirements of plant lighting circuits. Operates over a line-voltage range of 250-280 volts; applicable to circuits in the 265/460-volt-Y class.

Cuts ballast electrical losses 46 per cent for a given installation —an appreciable power saving.

Saves nearly 50 per cent in ballast materials for a given number of lamps.

THE new G-E four-lamp ballast—made possible by General Electric's revolutionary sequence-starting circuit—opens the way to simplified fluorescent fixtures that cost less, weigh less, and use much smaller amounts of critical materials: copper, iron and steel, and aluminum.

Compared with two 100-watt Tulamp ballasts—the most economical type previously available—the new four-lamp ballast requires 48 per cent less copper, 47 per cent less iron and steel, and 50 per cent less aluminum.

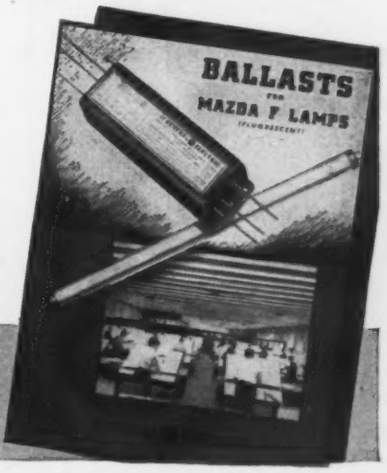
Savings in Copper for Plant Circuits, Too

Circuits carrying power at the higher voltages (between 250 and 280 volts) necessary for the operation of the new ballast require much less copper than circuits carrying the same amount of power at lower voltages. For example, on a single-phase circuit only one-fourth to one-third as much copper is required to carry power at 265 volts as would be required to carry it at 115 volts. Many new war plants—particularly those with load-center distribution systems—will have Y-connected circuits of 254/440, 265/460, or 277/480 volts, to all of which the four-lamp ballast can be connected line-to-neutral. Other plants converting for war production can often provide one of these voltages on their lighting circuits.

The four-lamp ballast has the same mounting dimensions as the G-E Tulamp ballast.

Power factor of the four-lamp ballast, like that of the Tulamp ballast, is above 95 per cent.

Write today for complete information on this remarkable new ballast. Ask for Bulletin GEA-3293D. It contains information on the complete line of G-E ballasts for all MAZDA F lamps from 4 to 100 watts. *General Electric Company, Schenectady, N. Y.*



The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment

GENERAL ELECTRIC

408-9-8205

Locating Customers on Rural Lines

By K. M. NORCROSS
Distribution Superintendent
Sherrard Power System, Orion, Ill.

A method has been devised whereby any employee of the Sherrard Power System can locate a customer in 60 seconds, regardless of section, township or county. The company serves approximately 1,300 farms in three counties. It is beyond human possibilities to remember the exact location of each customer.

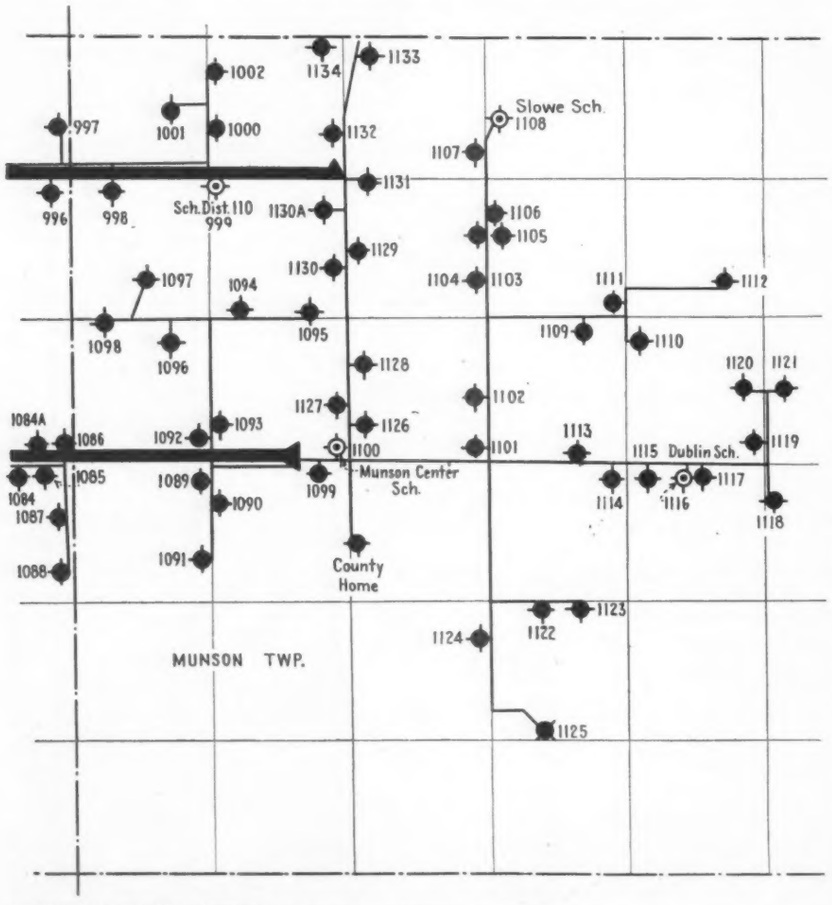
A map of the entire system has been prepared and every farm is indicated on the map, in its exact location, by a black circle. Alongside the circle there appears a number which corresponds to the ledger account number of that particular farm. A small portion of the system map is illustrated.

The method is as follows: If John Jones calls the office and reports that he "has no power," the ledger index is consulted for his account number. A work order is then made stating the name, nature of the call and account number and it is given to a service man. The service man consults his copy of the map to locate the black circle bearing that number and proceeds on his way directly to the farm without unnecessary mileage.

•

Shunt Capacitors Ease Municipal Distribution

In 46 months the municipal distribution system of Palo Alto, Calif., saved $16,350 in energy losses by the installation of 945 kva. in 15-kva. capacitor units at an over-all cost of $6,900. They have been distributed over the six 2.3/4-kv. feeder circuits. Amperes carried by the feeders were reduced by 20 percent and this has also given the feeder regulators chance to take on a corresponding increase in loading without installation of additional copper or equipment. The town's electrical engineer says: "If there is anything about them to get out of order it has not shown up in our 46 months experience."



SECTION OF MAP devised to locate customers on rural lines, identified by ledger account numbers

Silver Used in Graphite Brushes

Utilization of silver in combination with graphite to form brushes for electrical equipment has been a study by the American Silver Producers' Research Project and others interested. According to the project several manufacturers of brushes list those containing silver for specific applications or classes of use, and the use of the brushes has been demonstrated in numerous cases.

Among the conclusions reached as a result of certain tests conducted by the research organization are:

A silver film is established on the brush track when silver-graphite brushes are used under certain conditions, depending in part upon polarity, current density and brush pressures.

Brush contact drop is very low for brushes with high silver content and is less affected by humidity than with copper-graphite brushes.

Excessive brush wear against copper surfaces occurs if brushes contain more than 90 percent of silver, and against iron slip rings when brushes contain over 75 percent of silver.

Silver-graphite brushes do not score steel and cast-iron slip rings at speeds at which scoring is caused by copper-graphite brushes.

Although silver films are subject to tarnishing, the silver sulphide coating formed has much higher electrical conductivity than does the film of copper oxide which forms on copper.

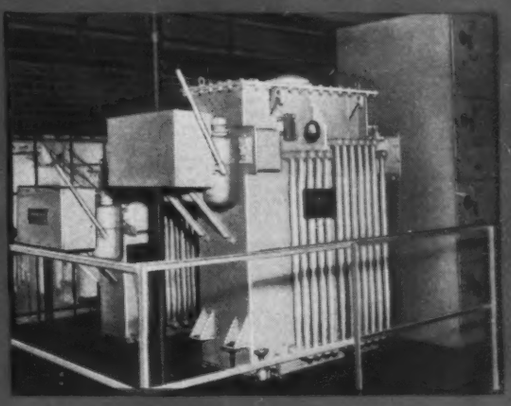
Data resulting from some of the investigations are available through Handy & Harmon, New York, in charge of the above-mentioned project.

•

Service Boxes Are Easily Reclaimed

Both steel and aluminum service boxes are repaired and reclaimed by a power and light company for repeated reuse on customers' services. Principal work involved is removal of dents, cleaning with wire buffer and replacement of knockouts. Knockouts are replaced by tacking aluminum disks over the holes, using a small acetylene flame and an electrode designed for electric welding as welding rod. Steel boxes are painted, aluminum boxes are not.

IT TAKES *less than an hour* TO WRITE THE SPECIFICATIONS FOR STANDARD G-E UNIT SUBSTATIONS



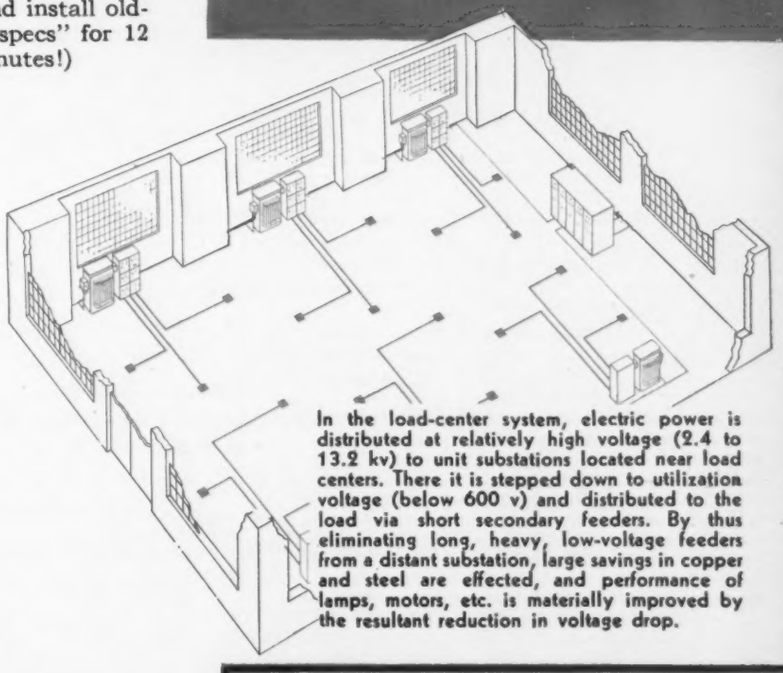
Load-center unit substations are quickly and easily installed—simply slide the completely assembled sections into position, bolt together, and connect the primary and secondary cables. Pyranol, being noninflammable, permits units to be installed right at load-centers without expensive vault construction.

LOAD-CENTER unit substations, for service in a *modern* load-center power distribution system, can be quickly and easily specified, ordered, and installed—permitting time savings of *one to six months* over the time required to design, obtain, and install old-style, "piecemeal" equipments. (In a recent case, the "specs" for 12 identical 2000-kva units were entirely written in 15 minutes!)

By specifying standard units, you avoid spending those weeks of time over the drawing board and in long, drawn-out correspondence. And standardization promotes efficient mass production to expedite deliveries still further while lowering the cost to you.

Purchasing a G-E unit substation is not much different from buying an automobile. In a recently completed plant, for example, the consulting engineer had used these compact, safety-metal-enclosed units and consequently was weeks ahead of schedule. After a sudden change in load conditions, he discovered he needed two more units to provide the necessary capacity. Referring to a G-E bulletin on his desk, he called the local G-E representative and ordered ". . . two more exactly like the unit in Fig. 12, page 22." That's all there was to it, and he received prompt delivery.

These completely factory-assembled unit substations consist of metal-clad primary gear, a Pyranol (noninflammable) transformer, and a low-voltage-feeder section with drawout air circuit breakers. They are designed for serving loads 600 volts and below from incoming lines up to 13.2 kv. They are quickly and easily installed near electrical load centers without expensive vault construction—and additional units can be installed WHEN and WHERE needed. Your local G-E representative will be glad to work with you on your particular application. General Electric, Schenectady, N. Y.



In the load-center system, electric power is distributed at relatively high voltage (2.4 to 13.2 kv) to unit substations located near load centers. There it is stepped down to utilization voltage (below 600 v) and distributed to the load via short secondary feeders. By thus eliminating long, heavy, low-voltage feeders from a distant substation, large savings in copper and steel are effected, and performance of lamps, motors, etc. is materially improved by the resultant reduction in voltage drop.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

General Electric Co., Sect. A 302–9
Schenectady, N. Y.

I understand your new handy guide to "Quickly Installed Electric Power Systems" (GED-1006) explains in detail the steps to follow in order to get power to new production machinery in one to six months less time.

Please send me a copy.

Name_____

Company_____

Address_____

City_____ State_____

305-9-9725

GENERAL ELECTRIC

How to Seal Duct Openings*

All ducts entering customers' premises, station or substation buildings or vaults shall be sealed water and gas tight. Ducts which enter a building or vault from street shall be sealed at the building (or vault) end only.

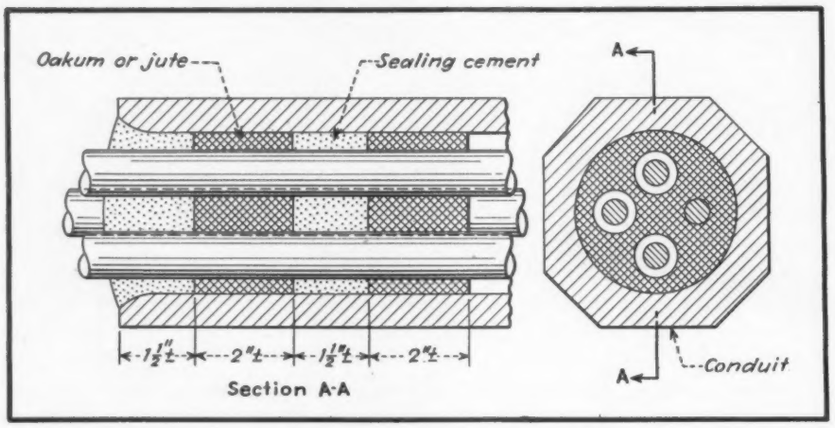


Fig. 1—Sectional view of duct showing how sealing materials are to be packed between the various cable conductors and the duct

The following methods of sealing ducts shall be used:

I—LEAD-COVERED CABLES

(a) Paint all of the cables in the duct from a point at least 6 in. inside the duct to a point 2 in. outside of the duct mouth with black asphaltum base paint (P.B.)

(b) Starting at a point 5 in. back from the duct mouth, thoroughly calk around all cables with oakum for a distance of 2 in. back into the duct.

(c) Pack plastic cement against the oakum for a distance of approximately 1½ in. Be sure that this is thoroughly packed around all cables.

(d) Calk around all cables with oakum for a distance of 2 in.

(e) Thoroughly pack plastic cement on top of the oakum for a distance of 1½ in. and finish smoothly to duct mouth.

(f) Paint over cement and around all cables with black asphaltum base paint (P.B.)

Cables shall be separated from each other and from the duct mouth by the sealing material when the operation is complete.

II—BARE STRANDED CABLE

(a) Open the strands of the cable inside of the duct line by inserting a screwdriver between the strands and twisting.

(b) Paint between the opened strands with asphaltum paint.

(c) Pack duct-sealing cement tightly between the open strands for a distance of approximately 3 in.

(d) Remove screwdriver and tighten strands to their original position or as nearly as possible.

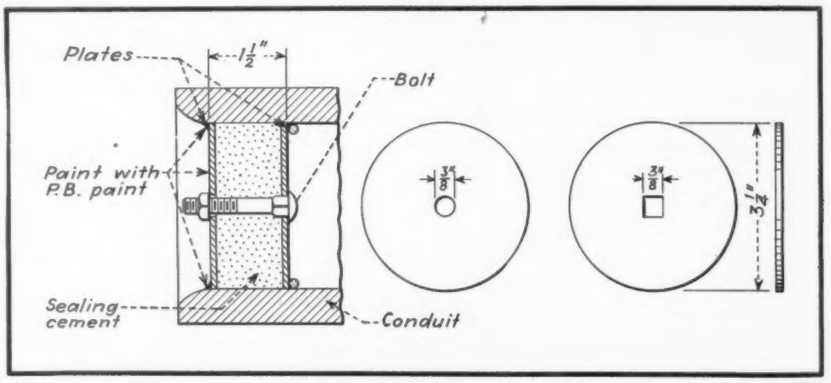


Fig. 2—Packing plates for sealing empty ducts, made of 12-gage sheet metal and assembled with 5/16x12-in. galvanized carriage bolt

(e) Bind strands firmly together with two layers of friction tape ½ lapped for a distance of at least 1 in. each side of sealing compound.

III—EMPTY DUCTS

Use duct-packing plates and bolts (Fig. 2) for sealing ducts that are empty.

(a) Before inserting these plates into the duct assemble the plates on the bolt and tighten the nut until it is flush with the end of the bolt.

(b) Pack duct-sealing compound tightly between plates and flush with edge of plates.

(c) Roll the plug on a flat surface, applying sufficient pressure to insure the cement being rolled even with the edges of the packing plates.

(d) Tighten nut a few threads and again roll the plug. Wipe off all cement that may have worked over edge of plates.

(e) Paint inside of duct for a distance of at least 4 in. with a light coat of black asphaltum paint.

(f) Insert completed plug into duct at sufficient distance so end of bolt will not protrude beyond duct edge.

(g) Tighten nut until a small quantity of the cement is squeezed out around edges of plate. Smooth this cement with the fingers and paint cement and plate with asphaltum base paint.

IV—NON-LEADED INSULATED CABLES

(a) Paint cables with black asphaltum base paint as in the case of lead-covered cables.

(b) Starting at a point 5 in. back from the duct mouth, thoroughly calk around all cables with untreated jute for a distance of 2 in. back into duct.

(c) Pack plastic cement against the jute for a distance of approximately 1½ in. Be sure that this is thoroughly packed around all cables.

(d) Calk around all cables with jute for a distance of 2 in.

(e) Thoroughly pack plastic cement against the jute for a distance of 1½ in. and finish smoothly to duct mouth.

(f) Paint over cement and around all of the cables with black asphaltum base paint.

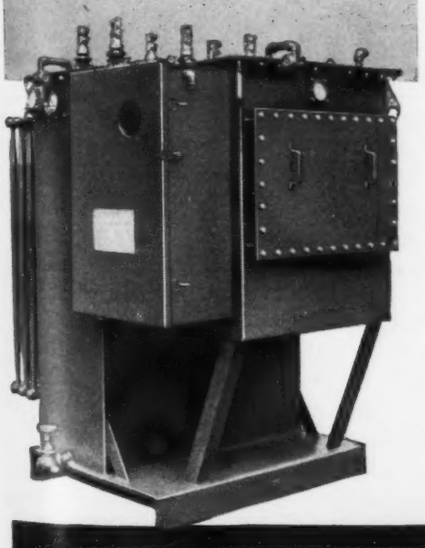
* From a book of standardized practices of Western Massachusetts Companies.

90,000 POUNDS OF COPPER*

350 MAN-HOURS*

*Savings on a typical 13.8-kv feeder by using regulators to maintain adequate voltage

You can really *save* with voltage regulators



Three-phase step regulator

TIME—the essence of all our war effort—as well as vital war materials can be saved by regulating feeder voltage. Regulators will bolster voltage that now sags under the heavy loads, permitting more electric power to flow through circuits supplying war plants.

A recent article in *Electrical World* (page 47, Jan. 10 issue) showed the surprising savings, cited above, that can be effected by using feeder-voltage regulators instead of re-building existing power lines or adding new ones.

And remember—voltage held at correct levels means good illumination for workmen, decreases waste and spoilage, and increases the response of motorized machines. Sum total—increased production!

REGULATORS OBTAINABLE QUICKLY

General Electric feeder-voltage regulators are obtainable promptly—for voltage control on circuits from 120 to 69,000 volts. Induction and step types—oil-filled, Pyranol, air-insulated—permit choice of a regulator *exactly* suited to the requirements. For complete information ask a G-E representative for Catalog GEA-2762B and Publication GEA-3779. *General Electric, Schenectady, N. Y.*

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

NEW METHOD for spray booth lighting triples effective illumination
There are 37 ft.-candles of illumination on the airplane wing parts being painted in the deep spray booth (left). Close-up at right shows prismatic reflector electrical connection and compressed air connection. Lights and wiring must be protected from explosive solvent vapors; air enters at side of unit and leaks out at top of housing, preventing accumulation of vapors. Air is moved toward back of booth at rate of 100 ft. per minute.

How to Light Spray Booths

A new method of spray booth lighting which triples the effective illumination provided by previous schemes should have general application in the lighting of booths in which there is an explosion hazard, though its first application has been in the aircraft industry.

Spray booths may be lighted from locations classified as non-hazardous if the lighting units are outside of the explosive zone or designed so that explosive gases cannot enter the unit. Portable units cannot be used in a spray booth. Tests indicate that if approximately 10 ft.-candles of light are reflected from the work to the eye, nearly the optimum benefit is obtained. Because of reflection factor of the work, interception factors of workman's body and hands and machines and materials, it requires nearly 80 incident ft.-candles to secure the 10 ft.-candles.

This amount of illumination can be secured with the method illustrated by using 300-watt spray booth units spaced on 3-ft. centers along each side for booths 40 ft. deep and 15 ft. wide. For smaller booths fewer units or smaller lamps can be used.

Essentially, the new spray booth unit consists of a steel housing, glazed over the bottom with protective tempered glass, a Holophane "Controlens," a lamp and reflector all in the proper optical relationship. Unit is wired and serviced from outside the spray booth; incandescent or fluorescent lamps may be used.

•

Ratio Line Loss to Lamp Energy

By N. HENRY
Sectional Engineer, Edison Light & Power Company, York, Pa.

Percent of line loss is a factor of interest in the layout or analysis of series street light circuits. The value for either of two sizes of wire (Nos. 6 or 8) for five spacings of five different sizes of 6.6-amp. lamps can be read directly from the accompanying table. The table is thus of assistance in determining the requisite rating and setting of the constant-current transformers. It is also useful in determining where it is safe to install switches for cutting out lights during blackouts.

Percentage Line Loss for Lamps Installed on 6.6-Amp. Circuits

Lamp		Circuit	Distance Between Lamps in Feet				
C.P	Watts	Wire	500	400	300	200	100
60	47	8	30	24	18	12	6
		6	18	14.4	10.8	7.2	3.6
80	60	8	22.8	18.24	13.7	9.12	4.56
		6	14.3	11.34	8.6	5.7	2.86
100	72	8	19	15.2	11.4	7.6	3.8
		6	12	9.6	7.2	4.8	2.4
250	155	8	9	7.2	5.4	3.6	1.8
		6	5.5	4.4	3.3	2.2	1.1
400	244	8	5.6	4.8	3.6	2.4	1.2
		6	3.5	2.8	2.1	1.4	0.7

More Steam—How?

5. Copper on High-Pressure Boilers*

By ALFRED IDDLES
Application Engineer, Babcock & Wilcox Company

In checking the history of high-pressure boilers, it appears that the type of pitting discussed in the preceding installment occurred on some of the first 1,250-lb. units and still occasionally there is an eruption through such a pit. Whether it is an old one or whether the difficulty is still going on is almost impossible to determine.

In nearly all high-pressure boilers there are fairly large quantities of copper. Sometimes this shows up as flakes of metallic copper, sometimes it is reported as copper oxide. I have found no one who is certain as to the source of this copper, nor the mechanism whereby it is removed from condensers or heaters in the feedwater circuit. Some think that ammonia, which will continue to redissolve if not specifically removed, is the cause of this transfer from non-ferrous tubes to the boiler water. Some people have found that the condensed steam from the steam jet air pumps is heavily laden with ammonia, and if this is pumped back into the system, then the ammonia is not eliminated. Throwing this small amount of condensate overboard will decrease this ammonia and may be helpful in the difficulty.

What the effect of this copper is upon corrosion is uncertain. It has been observed, however, that metallic copper almost invariably appears in large quantities with this type of corrosion. In some cases it appears to have found its way in to the grain boundaries of the steel at the bottom of the pit. I believe it important that all of us at this time pay particular attention to this problem. We should determine, if possible, whether this copper is a cause or an effect, and I imagine the operators will be anxious to know where the copper comes from and determine if any appreciable damage is being done to other equipment which it might reach in the plant.

Summarizing what has been presented in the preceding installment,

* This series began in the May 16, 1942, issue of "Electrical World"; adapted from author's talk "What the Operator Wants to Know" to Steam Power Division, A.S.M.E. Metropolitan Section, March 25, 1942.

HOW TO CONSERVE COPPER

IN CABLE SYSTEMS FOR WAR-JOB PLANTS

Use HIGHER VOLTAGE

WHEN you are planning expansion of an electric distribution system, or revamping plant wiring, there is an opportunity to save copper (compared with previous practice) by using as high voltage as you can. For example, cable at 480 volts requires only 26 per cent of the copper required for distribution at 208 volts.

Other effective conservation measures, when planning plant distribution for war production, are (1) use a high-temperature insulation because temperature limits of the insulation govern the permissible copper size; (2) use three-conductor instead of single-conductor cable wherever voltage regulation is the deciding factor, because the reactance drop in a three-conductor cable is less.

HOW MUCH COPPER CAN YOU SAVE?—Ask Us

In practically every case there can be a choice between two or more cables to do a job well. One, however, may permit a saving in copper—and will also conserve other vital materials.

Let us help you determine the cables that will do the job successfully and that will also conserve copper. General Electric cable engineers, both in your section of the country and at the factory, offer their services in figuring for you, or with you, just what the opportunities are.

When you save copper in the cable, you conserve copper in that part of the plant electrical distribution system where the copper requirements are the heaviest. For additional information, just ask the nearest G-E office, or write to General Electric, Schenectady, N. Y.

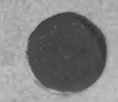
The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment.

NOT THIS

500,000 cir mils—conductor size for 208 volts

4.6 LB COPPER PER FOOT

BUT THIS



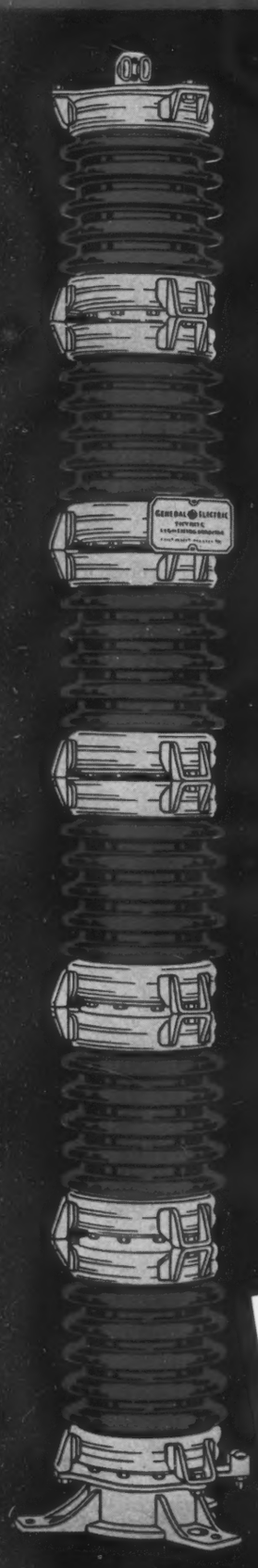
2/0 Awg—conductor size for 480 volts

ONLY 1.2 LB PER FOOT

GENERAL ELECTRIC

501-15-1200

STOP *Lightning's* SABOTAGE



NOW PREVENTION OF DAMAGE IS MORE VITAL THAN EVER

1. To protect new or old apparatus from damage and keep it delivering indispensable power.
2. To preserve investments in costly or virtually irreplaceable electric equipment.
3. To reduce repairs or replacements involving critical materials.
4. To prevent wasteful shutdowns of power service, with consequent loss of production.

SPECIFY THYRITE STATION ARRESTERS

. . . for dependable protection of generating and substation apparatus

They provide a wide margin of protection

G-E Thyrite arresters reduce lightning voltages to values far below the impulse-test strength of standard apparatus and basic insulation levels—even at the highest lightning discharge currents ever recorded through station arresters. Thyrite station-type arresters will easily withstand lightning discharge currents of 100,000 amp.

No disturbance of system power voltage

The valve action of Thyrite arresters prevents short circuits, outages, and other disturbance to system power voltage during the discharge of the lightning current.

Performance not affected by atmospheric conditions

The hermetically sealed gap elements are shunted and shielded with Thyrite of the same stability as the main valve disks. The result: sparkover voltage of the arrester is not affected by rain, fog, sleet, or stray electrical fields.

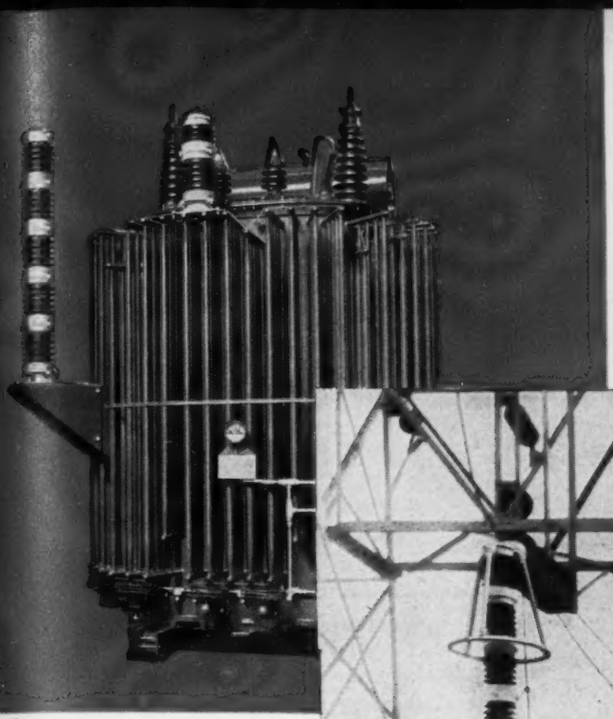
Liberal thermal capacity for repetitive or long-duration discharges

The Thyrite valve-element disks (6-inch diameter) provide a cross-sectional area of discharge path *far greater* than is obtainable in any other arrester. Also, the inorganic ceramic collar, integral with Thyrite disks, is an exclusive G-E advance in arrester dependability.

Unequaled service record

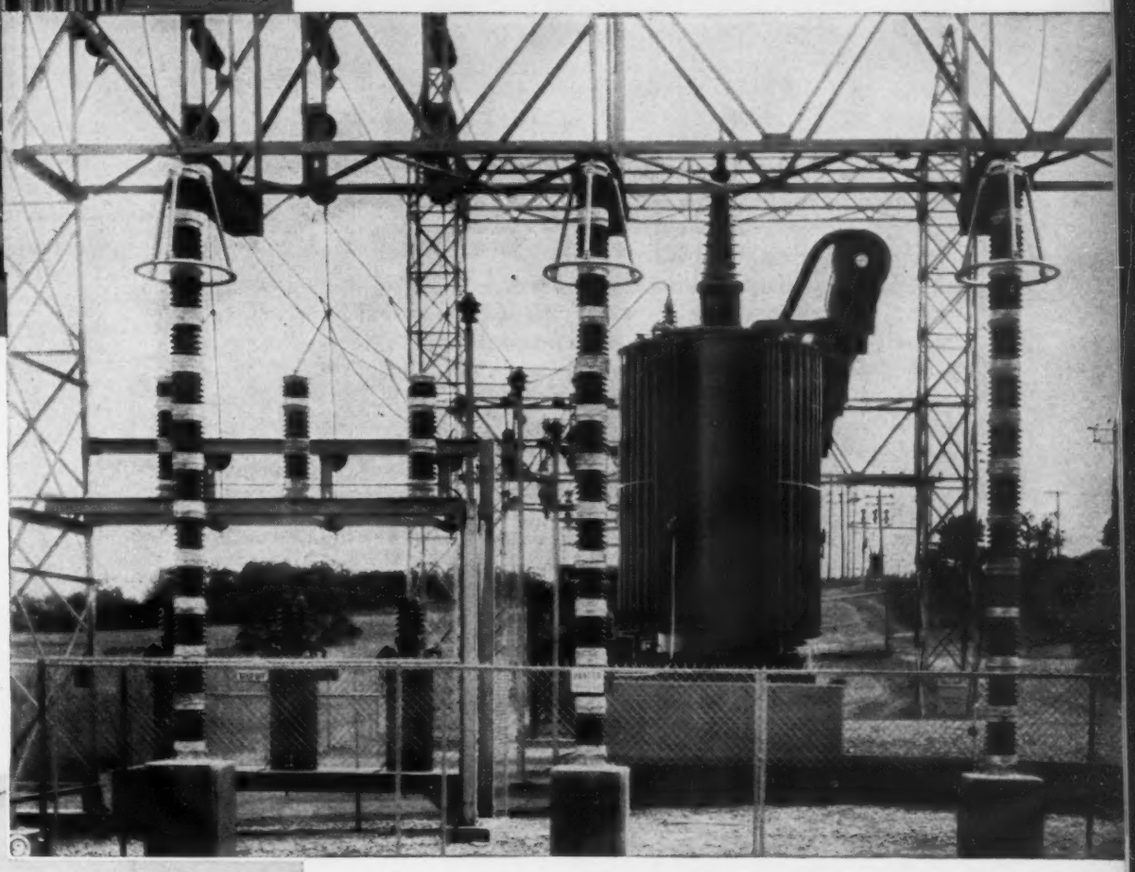
Since Thyrite arresters were introduced, in 1930, many thousands of them on circuits from 2.3 kv to 287 kv have established a performance record unequaled by any other form of station protection.

The amount of critical materials in a lightning arrester is **extremely small** compared with the amount of the same—or more critical—materials used in the electric apparatus protected.



EXCLUSIVE G-E 11.5-kv interchangeable units simplify installation and make it easy to change ratings of arresters in service

Thyrite arresters mounted directly on 5000-kva, single-phase power transformer for protection of both 69-kv and 23-kv windings.



Thyrite station-type arresters protecting a substation. The arresters on the foundation are 138-kv; those on the station structure are 34.5-kv.

Thyrite station-type arresters (34.5-kv) installed with simple bracket mounting on substation structure.

THE Thyrite 11.5-kv unit is *common to all standard system voltages*—23 kv, 34.5 kv, 46 kv, and up to 230 kv. Arrester units can be quickly assembled into stacks for any desired rating. Since the heaviest part—the 11.5-kv unit—weighs only 76 lb, equipment required for assembly is rarely more than a stepladder, and a wrench for tightening the three bolts between units. Three-point bolting prevents straining of the porcelains.

Easy to change ratings

Thyrite arresters are a *permanent* investment, because the units are never made unusable by changes in system voltage. Arrester ratings can be increased or reduced simply by adding or removing the proper number of 11.5-kv units.

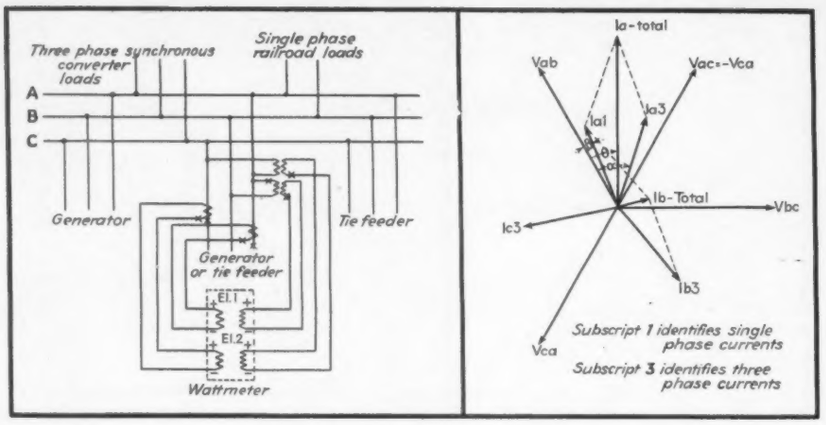
Little space is required for installation—whether on foundations, station structures, mounting brackets, or directly on power transformers. Thyrite arresters require no more maintenance than bus insulators.

Select your station-type arresters from Bulletin GEA-1304. *General Electric, Schenectady, N. Y.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment

GENERAL ELECTRIC

405-10-5600



SINGLE-PHASE LOAD on three-phase system metered with two-element polyphase wattmeter

it appears justifiable to conclude that:

1. The feedwater specialists have done a wonderful job in the last few years. However,

2. The operating organization should be particularly well equipped with technical men and apparatus to check continuously their feedwater conditions to prevent scale and corrosion.

Chemists and research groups should wake up and realize that feedwater problems for high-pressure boilers are only partially solved. This needs attention now and I suspect a tremendous amount of additional work before suitable answers are available.

•

Meter Single-Phase on 3-Phase System

By O. E. STAMM
Assistant Engineer, Consolidated Edison Company of New York, Inc.

The following simple method, based on the use of the two-element polyphase wattmeter, was used to determine the division of single-phase load between a number of generators and tie feeders connected to the bus of a system supplying single-phase railroad loads as well as three-phase synchronous converter loads. The method is subject only to the restriction that the single-phase load is supplied from one pair of lines and the three-phase load is balanced as indicated in the vector diagram.

From the vector diagram it can be seen that for the wattmeter connections indicated the torque of element No. 1 will be proportional to

$$P_1 = I_{A_T} V_{AB} \cos \theta$$

and the torque of element No. 2, which will be negative with respect to element No. 1, since the potential element is reversed, will be proportional to

$$-P_2 = I_{C_3} V_{AC} \cos \alpha', \text{ where } \alpha' = (\alpha + 180°)$$

The torque of element No. 1 may be considered as the resultant of two component torques proportional to

$$P_{1\text{-}1} + P_{1\text{-}3} = I_{A_1} V_{AB} \cos \beta + I_{A_3} V_{AB} \cos \alpha$$

The net torque acting on the deflecting system is the sum of the torques acting on the two elements and is

$$P_n = P_{1\text{-}1} + P_{1\text{-}3} + (-P_2) = I_{A_1} V_{AB} \cos \beta + I_{A_3} V_{AB} \cos \alpha + I_{C_3} V_{AC} \cos \alpha'$$

Since the torques of $I_{A_3} V_{AB} \cos \alpha$ and $I_{C_3} V_{AC} \cos \alpha'$ cancel each other, the net torque is due to $I_{A_1} V_{AB} \cos \beta$, which is the single-phase power.

The accuracy of the method is subject only to the usual limitations of power measurements involving power differences.

•

Conductivity Meters Give Carry-Over Data

An effective laboratory method of calibrating steam conductivity meters to give an indication of the conductance caused by carry-over of one part per million of soluble solids from boiler water in degassed samples of steam has been developed and successfully used at the Cedar Rapids plant of the Iowa Electric Light & Power Company.

To accomplish this when the company installed a new Straub degassing condenser and three point Micromax conductivity recorder at the plant in 1940, a sample of degassed steam was collected by overflow and conductance determined by means of a dip-cell and portable conductivity indicator. Increments of 0.2 percent boiler water (1,000 ppm.) were added up to a total of 1 percent and the increase in conductivity measured at each step. Results of these determinations are shown in the accompanying table. These results revealed that one micromho was equivalent to 0.45 ppm. solids. Subsequent experience revealed that the ppm. per micromho may go up to 0.58 with the same water source. This value should be determined at the time of test.

Experience with the conductivity measurement of degassed steam samples shows that normal conductance of steam at this plant is about 2.25 micromhos, equivalent to about 1.1 ppm. total solids or about 0.1 percent boiler water carry-over.

Prior to the installation of the de-

Total Solids Equivalent to 1 Micromho

Boiler Water 1000 ppm.

	Conductance Micromhos	Increase Micromhos	Ppm. per Micromhos
Condensate	3.10	.....	.....
plus 0.2% blr water	7.80	4.70	0.43
plus 0.4% blr water	11.70	8.60	0.46
plus 0.6% blr water	16.40	13.30	0.45
plus 0.8% blr water	20.80	17.70	0.45
plus 1.0% blr water	25.60	22.50	0.44
		Average	0.45

1 micromho equivalent to approximately 0.045% moisture.

Total Solids by Evaporation

Sample No.	Date	Sample Size	Total Solids Boiler	Total Solids Steam	Conductance Micromhos
1	3-26-40	16 L	760	1.33	Undegassified
2	4- 2-40	12 L	880	0.9	Undegassified
3	4-11-40	12 L	1030	0.6	Undegassified
4[1]	4-18-40	11 L	1132	3.5	Undegassified
5[2]	12-26-40	10 L	1270	1.04	2.35[3]

(1) Carryover indicated. (2) Sample taken while over 1,100–1,300 ppm. (3) Equivalent to 1.06 ppm.

gassing condenser the high values of gas in steam samples precluded attempts to correct indicated resistance of steam—as measured by a Micromax recorder—to a gas-free basis. Only reliable analysis for total solids in steam was by evaporation of a 10 to 15 liter sample. This required 75 to 85 hours and elaborate corrections for foreign solids. Total solids found in five such tests by evaporation are also shown in an accompanying table.

•

Safety Screen Used As Warning to Driver

A simple device used as a warning to a distribution ladder-truck driver that the ladder is in a raised position has been developed by members of a Utica line crew of Central New York Power Corp. Possible consequences can be easily imagined if the driver starts the truck before the ladder is lowered to a horizontal position.

RAISED LADDER, lineman at top

When the telescopic ladder is in the "up" position the driver may overlook this fact. So a safety screen operated by movement of the ladder was installed as an indicator for the position of the ladder and a warning to the driver.

When the ladder is raised it automatically lowers the screen in front of the windshield. The driver can see through the screen, but cannot overlook the warning that the ladder on the truck is still in the "up" position. When the ladder is lowered the screen is raised above the driver's vision.

LOWERED safety screen in front of driver

•

Two Methods Used to Acid-Clean Boilers

In the last few years there has been considerable progress in the development of inhibited acids which will remove scale but have little effect on the bare metal. Therefore, after obtaining the advice and approval of boiler manufacturers and of its own consulting chemical engineers, Public Service Electric & Gas Company concluded that it was safe to proceed with this method of cleaning boilers.

In 1939 acid cleaning of boilers was begun at Kearny generating station. The twelve boilers in units 1 to 4 at this station are Babcock & Wilcox Company cross-drum type, having a capacity of 250,000 lb. of steam per hour at 365 psi. and 750 deg. F. The furnace walls were originally refractory. Later they were partially equipped with water walls on the sides and rear. The fifth unit consists of three Springfield cross-drum boilers, equipped with full water walls and having a little larger capacity.

It was originally decided to clean these boilers completely as a unit, using a slow fire to control the temperature of the cleaning solution. A pump was connected in the boiler circuit to insure circulation through the water wall parts. Natural circulation was depended on for the sectional headers and generating tubes.

Muriatic acid and an inhibitor were introduced to the drum by means of a water injector through the safety valve connections. A concentration of about 400 grains per gallon was obtained by using from 50 to 60 carboys of acid per boiler. Circulation was maintained for about eighteen hours. If a concentration of 30 to 60 grains per gallon persisted at the end, the cleaning was considered complete. Otherwise, more acid was added and the process continued for a longer period, the boiler was drained and then flushed for two hours at a rate of 150,000 lb. per hour. Finally, it was neutralized with a charge of 200 lb. of caustic soda and circulation was continued for another 24 hours. After draining, flushing and inspecting it was refilled and returned to service. This method has proved successful in every respect and is still used without modification.

At Essex generating station the two high-pressure boilers were installed in 1928 and first cleaned by acid in 1940. They are Babcock & Wilcox Company single-pass, radiant type, having a maximum rating of 635,000 lb. per hour at 1,350 psi. and 950 deg. F.

In August, 1940, several leaking and blistered tubes were discovered in the primary furnace walls of No. 25 boiler. Inspection of these tubes disclosed a heavy scale at the point of failure and considerable sludge in the drums and in the bottom headers. These boilers had been in service for more than two years, and it should be emphasized that at no time prior to the failure was it possible to observe any excessive deposit on the tube surfaces. Turbining removed most of the sludge and heavy scale. However, a layer of hard scale of less than eggshell thickness remained even after several passes of the tube turbines. This scale was very tenacious, and although very thin it was believed advisable to try acid cleaning.

Sections Isolated

In order to maintain a very close control, an entirely different procedure was developed from that used at Kearny station. It was decided to clean the tube surfaces surrounding the primary furnace, doing each section separately. For instance, the east side wall is isolated from the downcomer and other sections by plugging the supply pipes with big rubber stoppers. These plugs are held in place by jack-screws. The acid solution is pumped through four hoses

into the bottom header through special hand-hole caps. It is allowed to overflow from the top header back to the mixing tank through four similar connections.

For cleaning purposes these high-pressure boilers are divided into six sections: Two primary furnace side walls, two secondary furnace side walls, one secondary furnace rear wall, one primary furnace floor tube, slag screen and arch tube section (consisting of a double circuit).

Twice a year the primary furnace tubes, including the side wall, floor, arch and slag screen tubes, and the secondary furnace side walls are acid cleaned and then turbined. Once a year at Burlington and Marion stations the secondary furnace rear wall tubes are acid cleaned and then turbined. Once a year at all three stations all remaining tubes subject to heat which had not been acid cleaned and turbined will be turbined only.

The acid cleaning will be done by sections, pumping dilute hydrochloric acid, with a suitable amount of inhibitor through the tubes. The solution is to be at a temperature of 150 deg. F. and a strength not exceeding 600 grains per gallon, measured at the boiler inlet. Pumping is to continue until the strength at the boiler outlet remains approximately constant at 450 grains per gallon for two hours. The boiler will then be drained, refilled with water and then a caustic soda solution until the discharge is alkaline, and then flushed with fresh water.

• • •

Low-Burden Ammeter for Relay Testing

By H. L. GOODRIDGE
Relay Tester, New England Power Service Company, Malden, Mass.

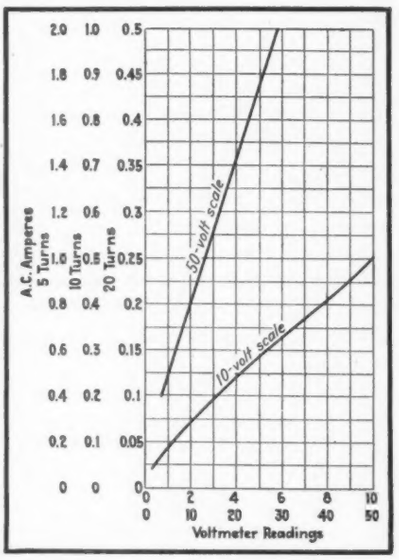
To meet the need of a sensitive 0.25-amp. a.c. ammeter, but with a burden low enough for satisfactory results where bushing current transformers are used, standard equipment with only slight changes was utilized.

The basic instrument is a standard vector-type Multimeter having 10- and 50-volt a.c. scales and a sensitivity of 1,000 ohms per volt. It was being used as a circuit tester.

Second piece of equipment is a 4-watt universal line-to-speaker output transformer having a 1,000-ohm primary. Its "line" winding is connected to the voltmeter. A 0.2-ohm shunt is used across the "speaker" winding, which is connected in series with the current to be measured.

To have the instrument sensitive to harmonics as well as the fundamental 60-cycle wave, the smallest section of the "speaker" winding could be used, but the wire size was too small for safety. The winding was removed. On the core was wound a coil of 20 turns of No. 16 wire, tapped at 5 and 10 turns.

Then the instrument was calibrated and a calibration curve drawn, as illustrated. A new scale was not made because the instrument is to be used for other purposes. The burden was difficult to measure, but it does not exceed 0.4 volt-ampere at one ampere and is probably less than half of this value. Accuracy is probably not very good, but the ammeter is more accurate for the purpose intended than the conventional instrument with its necessarily high burden.



CALIBRATION CURVES for low-burden ammeter

For checking current in differential relays and ground relays the instrument has been used with considerable success. Even on this sensitive ammeter current is not indicated for some ground relays on transmission lines. In these cases the trip wire has been removed and one of the phase currents "jumped" to ground. The unbalanced burden is enough to cause current to flow in the neutral and check its continuity. Cost of the instrument and transformer was less than $20.

•

"Loop" Cable Joint for Dead-Ending

An unusual "loop" cable joint, for the straight splicing together of two adjacent and parallel cables, has proved useful for air-raid repairs, in that the method enables the entire job of excavating and splicing to be done with a minimum of cost, labor and, more important still, during one full period of daylight, according to the *Electrical Review*.

This method used, for example, when a substation on a ring system is lost as a result of enemy action and it becomes necessary to complete the ring by splicing together the incoming and outgoing feeders, which are frequently laid parallel in the ground for a considerable distance. Conventional practice is to expose a sufficient length of one cable, cut it and turn it back on itself to such a position that it can be spliced to the other cable. This requires a considerable amount of digging, often extremely difficult because of pipes, other cables, etc., in the ground, and usually takes up a number of valuable hours.

With the new method a hole sufficiently large to carry on the splicing is dug, both cables are cut and the cores of one are spliced to the cores of the other by means of round copper rod bent to a horseshoe shape and drilled at the ends to form ferrules. Core cuts are stepped to aid in phase identification and the insulation built up, using hand-applied paper strip. The joint is then inclosed in a lead box made up in two halves, each of which was formed by beating out a section of lead tubing. The box is sealed with insulating compound.

It is interesting to note that the detailed design of the joint was determined largely by the fact that experience has shown that although first considerations are generally solely from the point of view of continuity of supply and, therefore, are probably considered temporary, a later consideration of the situation may dictate a change in substation site and thus the temporary work of today becomes the permanent work of tomorrow.

Electric Welding and TIREX CABLES

Welding, as a process, is very old but with the advent of electric welding new fields of usefulness were opened up. Along with the rapid development and steady improvement of electric welders there have been equally interesting and important changes in the power and electrode cables used with them. Cables for such service must have flexibility, they must resist abrasion and they must be economical in operation.

Among the first TIREX rubber-sheathed cables designed for special work were TIREX Welding Cables having conductors made up of thousands of small copper wires to obtain flexibility (#4/0 has 5341), a tough rubber sheath for resistance to abrasion and with every promise of unusual serviceability. Performance records have repeatedly shown TIREX Welding Cables to be unexcelled in every way for the work they were designed to do.

TIREX SELENIUM Rubber Armor — Unequalled for Long Life, Toughness and Resistance to Abrasion

TIREX rubber-sheathed Welding Cables are subject to War Production Board restrictions governing the use of copper and rubber but even with necessary modifications they still are suitable for the rough-and-tumble work of welding and can be depended upon for excellent performance. While they are not available for purely commercial uses they should be specified and used by industries on essential war work having high priority.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex WIRES and CABLES

Correct Compensation Will Salvage Revenue

By B. E. ELLSWORTH
Electrical Engineer, North Platte, Neb.

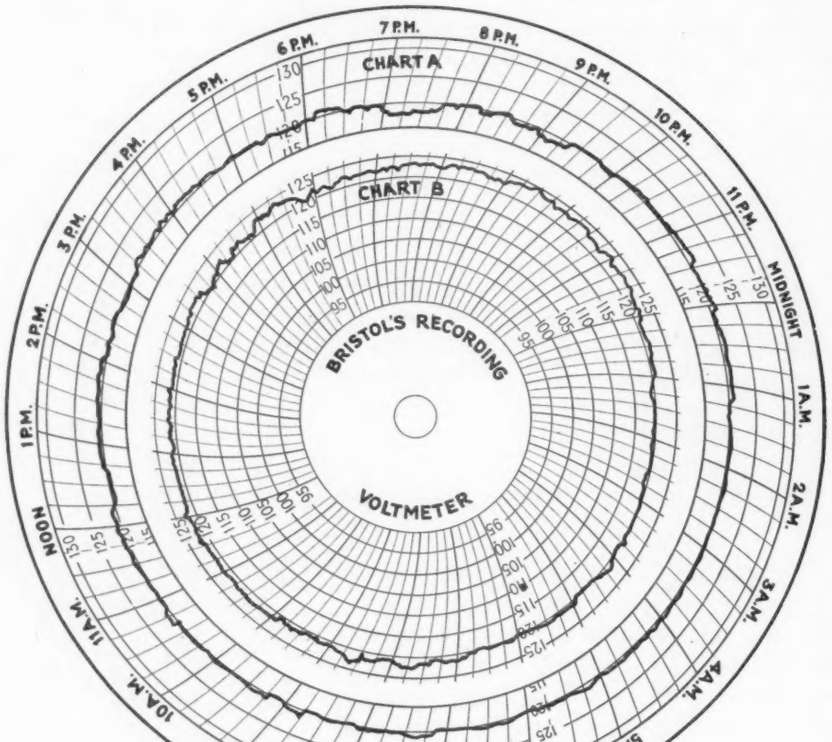
Because of the general tendency to compensate voltage regulators for a point on the primary circuit (under compensation) instead of compensating it for the secondary circuit (over-compensation with respect to the primary circuit), many induction and step-voltage regulators are not correctly adjusted. The accompanying charts illustrate the contention.

Of these two primary voltage charts, "A" is almost a circle and "B" an ellipse. The round chart is produced by compensating for a point on the primary circuit. At peak loads there will be a considerable voltage drop in the distribution transformers and secondaries, so that customer service voltage will be much lower than during light load.

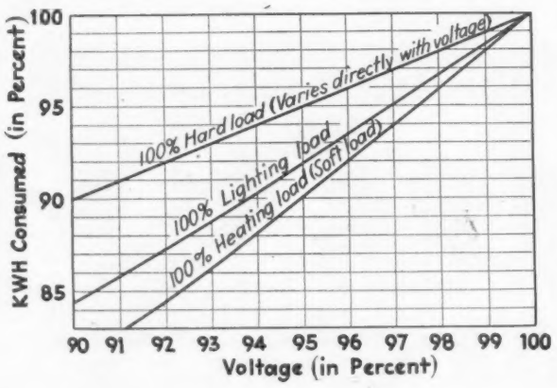
The elliptical chart "B" is produced by compensating the regulator for the secondary circuit. With this compensation the primary voltage rises several volts on peak and falls several volts at off peak, but customer (secondary) voltage is nearly constant.

Maintenance of near-constant voltage at the customer's entrance not only reduces service complaints but results in more energy sales to the utility. The energy consumed by a lamp decreases as the 1.6 power of the voltage and as the second power of the voltage for heating appliances. While the customer may operate his range longer on low voltage in order to get his cooking done, nevertheless the job competes poorly with other fuels. Energy lost on a lighting load due to poor voltage is really lost.

Lost load depends upon the ratio of heating to lighting devices on the lines. The accompanying curves show the percent of energy used with loads of varying degrees of hardness, a soft load being defined as one that decreases rapidly as voltage drops.



IMPROPER regulator compensation kills revenue and brings complaints. Chart "A," compensated for primary voltage, brings dip in customer voltage on peak. Chart "B," compensated for transformer and secondary drop, keeps service voltage constant at all loads



LOSS of energy consumption with low voltage is function of ratio of heating (soft) load to lighting or motor (hard) load

•

Refinements Improve Industry Service

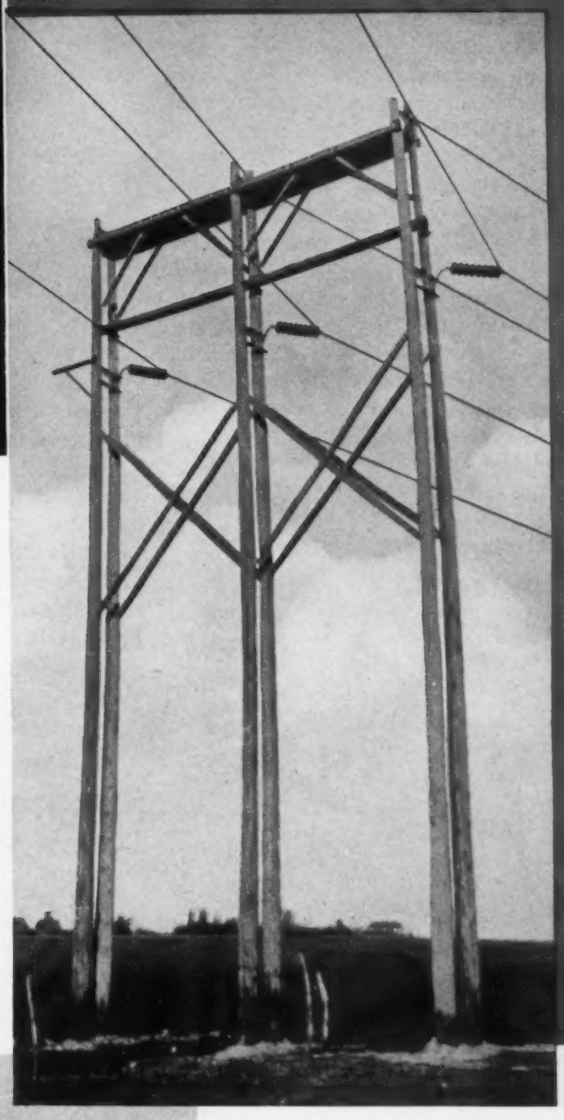
More and better relaying is being done by the Montana Power Company in its own system and in tie-ins with the Montana-Idaho-Utah transmission line, as well as various switching improvements in connection with customer service. As regards relaying, there have been inadequacies in the past and a need was felt for better and quicker-acting relays. Betterments along this line have been going on for some time, but war conditions have now emphasized the need.

Recently they have installed two new Westinghouse switches at the terminus of two Great Falls tower lines and are also putting in improved, low-tension switches in the bus tie between the Missouri River and Great Falls substations.

However, equipment so displaced by no means represents a loss. For example, four E.E.E. type K 15 switches have been made available for improved service first by modifying the bearings and then adding more spring tension. The original bearings had been steel shafting against cast iron. These were replaced by modern Timken bearings, the changes resulting in a notable speeding up of the action. They were installed at Thompson Falls and it was found that the changes cut the opening time from 25 cycles to 12 cycles.

Along the lines of switching improvements, the company has a customer at Heath utilizing 750 kw. in the production of gypsum board,

BUILD THOSE LINES



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PAGE & HILL CO., Minneapolis, Minn.,
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Insures Longer Pole Life!

Though building for today's emergencies, you are also building for the future. Build with poles that have been treated full-length for extra years of trouble-free service. Life-Span Cedar Poles are especially tox-i-tized to add to the normal long life of cedar tops. Here you have all that has made cedar supreme among pole timbers—lightness, straightness, strength, low gravity center, high insulating value—plus full-length decay resistance and insect immunity from top to butt! In Life-Span Cedar Poles you have strength and soundness that will last. You have true power line economy. Order Life-Span!

Life Span

CONSOLIDATED TREATING CO.

MINNEAPOLIS, MINNESOTA

now very necessary to defense building activities. This customer is served by a 20-mile, 15,000-volt line. It is essential that there be no interruption of service, so the Montana Power Company has installed automatic, reclosing circuit breakers to avoid shutdowns due to lightning or other causes. This represents a refinement on the system that under normal conditions would not be deemed necessary in this type of operation, but now nothing is too good if it will act to save man-hours of activity in an essential plant.

At the end of a 90-mile line is another, different type of customer, a strip coal mine using the largest type of super-shovel employed for such work. The three essential movements in this type of equipment are actuated by direct-current motors with Ward Leonard control supplied by a motor-generator, each shovel having its own motor-generator unit. Problem: to drag enough current from a 90-mile line, of only one-third the needed capacity. This is being solved by the installation of automatic power-factor regulators for the motor-generators.

•

From Water- to Air-Cooled, Same Ratings

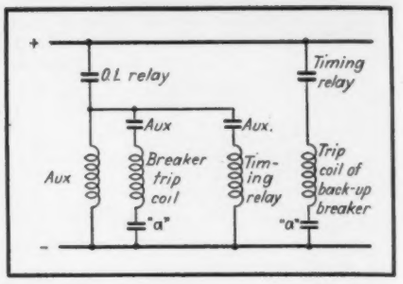
The three transformers loaded on a flat car and the three others hooked up in a substation in the accompanying pictures represent two aspects of the versatility that is required in electric utility operation in these wartimes. As originally purchased for installation in 110-kv. substations of the Alabama Power Company, these units were water cooled. So they operated in their designed locations for many years. Then came the energy shortage in the Southeast and the rapid expansion of industry for war production. It became necessary to move these two banks of transformers to other locations.

But in neither of the other locations was there water available for cooling. Radiators were designed by utility engineers, furnished by local manufacture and attached. The water coils were taken out of the tanks. The transformers on the car are now in operation supplying service to a war industry plant. They were originally rated at 2,000 kva. each with 55 deg. rise. Working self-cooled, they now have the same rating and the same rise and they will carry 2,500 kva. each under forced air cooling. The other three units were each originally rated at 4,500 kva., 45 deg. rise. In their new location they operate at the same rating and temperature rise, self-cooled.

•

Time Relay Extends Breaker Life

Useful life of a circuit breaker at a given location can often be extended, after system growth has made maximum fault currents exceed its interrupting capacity, by the scheme illustrated. When the overload relay closes its contact it picks up an auxiliary relay which not only energizes the breaker trip coil but also a timing relay. The timing relay is so set that if the breaker clears the fault in normal interrupting time from the instant that the overload relay contact closes the last-named will have reopened before the timing relay has made contact, producing instantaneous reset of the latter. But if the interrupting time of the breaker is a few cycles in excess of normal, distress is indicated, the timing relay will close contact and trip the back-up breaker, with a good probability that an explosion of the first breaker will be avoided.



SCHEMATIC DIAGRAM of relay and breaker arrangement

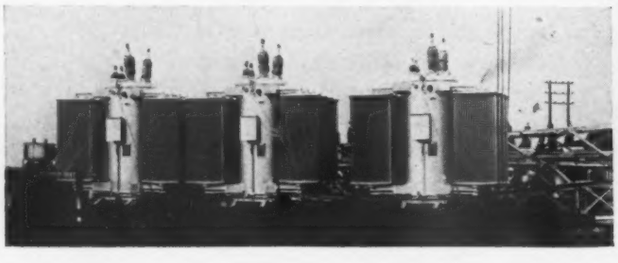
Thus the breaker is useful as a load switch and for interrupting the majority of faults, and only calls for the operation of the back-up breaker (with additional interruption of facilities) in the occasional case where it actually shows distress. This is a variation from the more common overcurrent blocking relay scheme which assigns a safe *current* interrupting capacity to the breaker, whereas this scheme assigns a safe interrupting *time*.

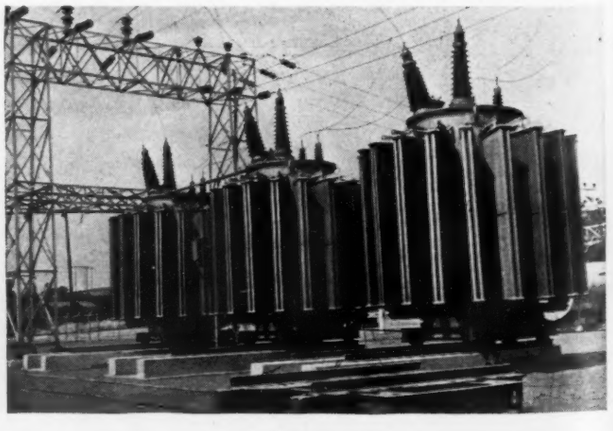
•

Salvaging Taped Connectors

Either steam or a trichlorethylene ($CHCL{:}CCl_2$) vapor degreaser can be used to loosen tape on mechanical connectors that have been salvaged from overhead lines and are being reconditioned as a conservation measure. Of these two methods, used by an Illinois utility, the degreaser is perhaps the more effective, but also requires elaborate equipment that may be uneconomical if volume of work is not great. Tape can be removed from small batches by putting them in water kept boiling over an electric hot plate or other heat source. After tape

REVISED cooling on these big transformers





Boils tape off

has been removed, this company uses either the degreaser or penetrating oil to brighten and remove any tar residue. The degreaser, however, tends to "whiten" the connectors. Penetrating oil requires wiping.

•

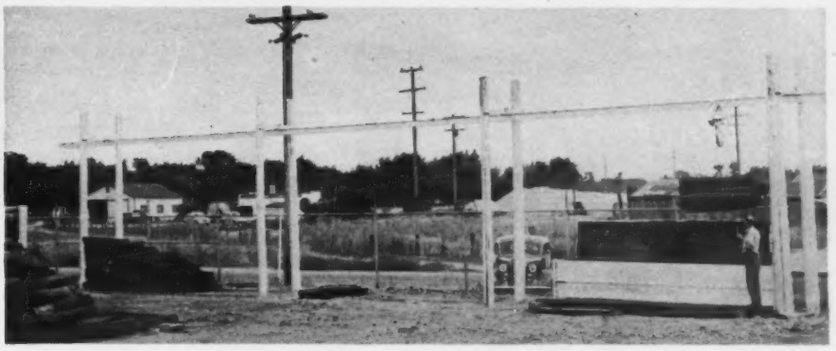
Testing Socket Type Meters

The Eastern Oregon Light & Power Company, Baker, Ore., recently developed a method of testing socket type meters described by L. E. Wiggans in a paper prepared for the Northwest Electric Light Association:

"We made a bracket of channel iron, securely attached it to the cowl over the instrument panel, and to this bracket we bolted an ordinary meter base. This base had slots in the back for easy removal when not in use. An ordinary 4x18-in. (outside diameter) fire hose reel was mounted on a car in such a way that 175 ft. of two-conductor, No. 12, rubber-covered cord could be reeled on or off, large enough and long enough to reach to any meter we have to test. By mounting the reel on the right side of the car behind the seat or on the running board, there was no trouble in reeling out or in. The end of the cord next to the hub of the reel was attached to a terminal block, also mounted on the reel. The outer end of the cord was attached to a plug made up by using the base of a socket type meter. The cord was attached to this plug in such a way that when it was inserted into the meter base the customer had service, and potential was in the car. The plug was insulated so that when a metal cover was used the equipment was free from grounds.

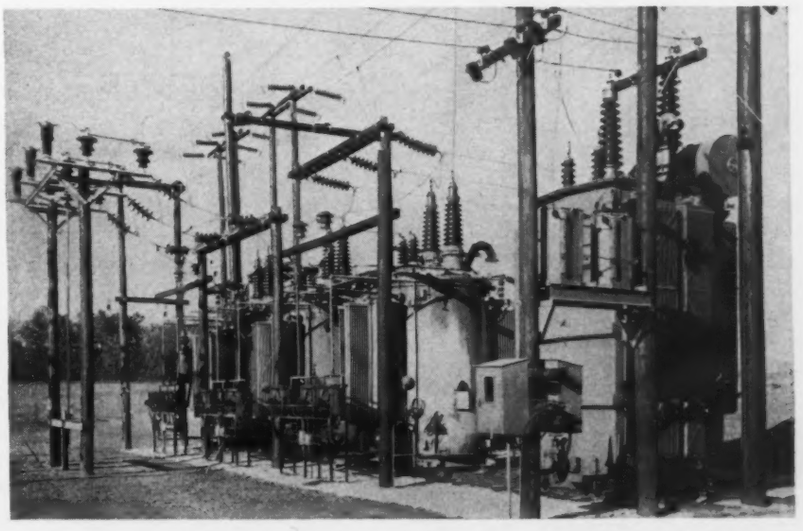
"In testing, a two-wire jumper is used to connect the contacts of the meter base to the contacts on the reel. Test jack is inserted in the base in the same way it would be done on the customer's premises. Portable test meter and phantom load are similarly placed on the seat and connected to the test jack. The tester walks to the house and, after removing the meter, plugs in the cord, which restores service to the customer and carries potential to the car. He takes the meter to the car and plugs it in the test jack, connects his jumper to the contacts on the reel, and now makes his test in the same way he would if the meter were at the house. "All of the meters in a given area can be tested from one set-up by simply inserting the blank plug into the base to restore service to the customer while his meter is out of place. The test leads need not be disturbed until the end of the day and then they can be put away. This saves much time and wear on the equipment, for, once the set-up has been made, the only changes needed occur when several types and sizes of meters are tested."

Making Keys From Pole Tops



During reconstruction jobs the Idaho Power Company recovers a number of poles in good condition from the ground line up. These are being cut into 5-ft. lengths and split two or three ways, depending on the size of the pole. These pieces make good, heavy keys when they are all treated in the company's creosoting tank. This procedure not only accomplishes a saving in wood, which may now be considered a critical war material, but the work is done at an actual saving of 10 to 20 percent over the use of new lumber, a worth-while economy these days.

War-Time Substation Construction



This picture is interesting not only as showing the replacement of steel by wood poles and creosoted timbers but as an example of time and labor saving by using creosoted railroad ties as equipment foundations in place of concrete

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Load Curve Guides Radio Advertising

By HAROLD J. ROWE
Advertising Director, Iowa Electric Light & Power Company, Cedar Rapids

Electrical demand of a typical Iowa farm county was the window through which investigators recently peeked to find out about the farmer's private life. In trying to find some sound basis for scheduling its radio time directed to farmers, Iowa Electric Light & Power Company last April put a curve drawing wattmeter on the circuit feeding wholesale power to 1,252 strictly farm customers in Benton County, Iowa.

Not Too Early Risers

This demand curve showed a lot of interesting things about farm habits. It showed, for example, that the Benton County farmer does not get up before sun-up or work till late at night. It was apparent that about half the farmers started getting up at 5 a.m. The other half gets up at 6 a.m. The majority are operating on war time. In the evening the farm audience starts diminishing at an alarming rate immediately after 8:30 p.m. From an 8:30 peak of about 400 kw. the load drops to about 180 kw. by 10:30 p.m. Since there is a constant load during the night of about 120 kw., the actual load used was in effect 280 kw. at 8:30 and 60 at 10:30. In other words 22 percent of the audience is in bed at 10:30 p.m.

As indicated by the way he uses light, Saturday is the farmer's day of rest, Sunday is his day at home and Friday his night out. The curves show pretty conclusively that Sunday, therefore, is the best radio night; Friday and Saturday the worst.

That farmers are operating on war time seems to be proved by the break in electrical load that occurs promptly at 12 noon when the morning work and cooking load drops sharply.

Sunday load follows the pattern of the average weekday *except* that the maximum peak for the week occurred on Sunday evening at 8:30, indicating that more people are up listening to the radio at that time than at any other time in the week. Load for Saturday is substantially less than on any other day of the week.

Friday is the late night up. There is considerable more use at midnight than any other night of the week. It appears that Friday is the night for social gatherings in farm communities.

With the highest peak on Sunday night and the lowest peaks on Friday and Saturday nights, the obvious conclusion is that Sunday is the best radio night and that Friday and Saturday are poorest.

•

Read Rural Meters on Quarterly Basis

Lessons learned from experimentation with a block of several thousand rural customers have been incorporated in Wisconsin Public Service Corporation's newly inaugurated quarterly meter reading plan. A rubber conservation measure, it is expected to cut automobile mileage (for meter reading) by at least 50 percent.

Early experiences with several variations evolved a plan which uses 100 percent estimated readings during the two months of the quarter in which the reader does not call, followed by actual reading in the third month. If the customer desires actual readings every month he is furnished a supply of postcards, on which he can send in the readings.

For the two billing periods intervening between actual meter reading the customer receives an average bill based on normal monthly use. Records of use in the preceding months and for the same billing period the year previous determine this normal. The actual reading in the third month automatically adjusts the previous average bills. The meter reader prepares this third month bill as he reads and accepts payment for it. The customer's questions are handled at the same time.

Resorts Excepted

Special effort is made by the operating department to read demand meters monthly without making special trips. In resort territory monthly readings during the important summer months will continue, with the quarterly plan being effective at other times.

Where skips occur on the quarterly trip of the reader, this bill is also averaged unless the regular work of the operating department permits a prompt pick-up without extra traveling. Self-reading return cards are also used in some such cases.

Two different stickers were developed to accompany the first average bills. One is used for people who have been properly established on the cycle. It is attached to their first estimated average bill notifying them of it and calling attention to the fact that they will receive another next month and in the third month the meter will be read. The other sticker applies to the second group of customers, those who receive one average bill and then have their meters read,

GENERAL ELECTRIC ANNOUNCES

NEW FLUORESCENT LIGHTING INVENTION

saving millions of pounds of critical materials within next six months!

New Sequence-Starting Circuit uses only one ballast for four 100-watt fluorescent lamps . . . increases light output 8%

GENERAL ELECTRIC announces a revolutionary new type of fluorescent lighting circuit that can save millions of pounds of critical war materials within the next six months. The new Sequence-Starting Circuit requires only one ballast to operate four 100-watt fluorescent lamps in a single fixture instead of the two ballasts formerly required. Invented by a young Nela Park engineer, J. H. Campbell, and covered by U. S. Patent No. 2,266,619, it is now available for war industries.

Originally developed to save critical materials as an emergency alternative to the inductive method of operating fluorescent lamps, the new Sequence-Starting Circuit has surpassed all expectations.

Advantages of new circuit

1 Critical material necessary in ballasts cut approximately in half.

2 Cost of ballast equipment reduced 50%.

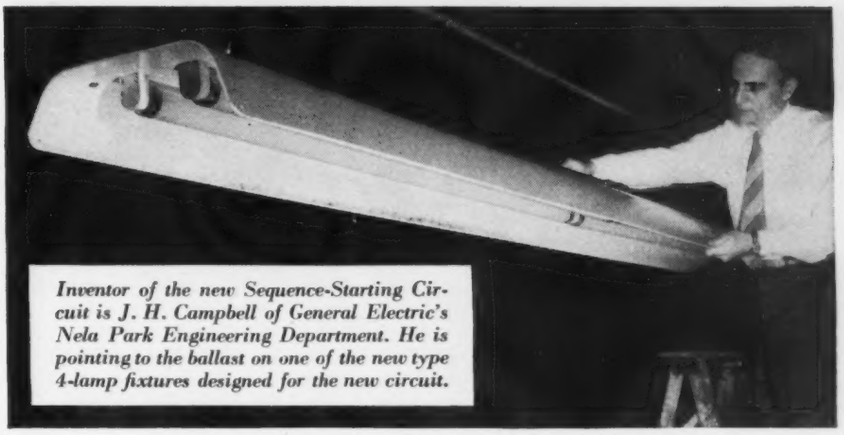
3 An overall reduction in fixture cost of approximately 20%.

4 Marked saving in weight.

5 Overall light output increased 8% per watt consumed.

6 Number of lead connections reduced from 8 to 3.

Although the Sequence-Starting Circuit may be used only on 254, 265 and 277 volt circuits, many new war plants have that voltage available while other plants can be changed over to take advantage of G.E.'s latest fluorescent development.



Inventor of the new Sequence-Starting Circuit is J. H. Campbell of General Electric's Nela Park Engineering Department. He is pointing to the ballast on one of the new type 4-lamp fixtures designed for the new circuit.

Savings Effected

The use of the Sequence-Starting Circuit results in important savings in critical materials. Per 4 lamp fixture these include:

Copper . . . 2.49 pounds.
Iron and steel . . . 8.8 pounds.
Aluminum . . . 0.345 pounds.

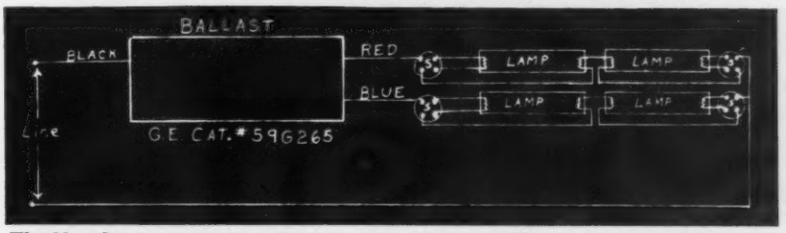
That's enough copper to make ten 20mm. cartridge casings . . . enough iron and steel to make thirty-five 20mm. shells . . . enough aluminum to make ten fuse primers.

It is estimated that potential savings that may be effected by this new circuit in the next six months are:

Copper . . . 500,000 pounds.
Iron and steel . . . 1,750,000 pounds.
Aluminum . . . 70,000 pounds.

For complete details, see your General Electric lamp division office or write General Electric Co., Dept. 166-EO-7, Nela Park, Cleveland, O.

HERE'S HOW THE NEW CIRCUIT WORKS:



The New Sequence-Starting Circuit requires only one ballast to take care of four 100-watt fluorescent lamps operated in series on a 254, 265 and 277 volt A.C. circuit. Each lamp requires one standard FS-74 thermal switch starter. The one split-phase ballast required is covered by U. S. Patent Nos. 2,056,629 and 2,025,471 held by General Electric. Certified by Electrical Testing Laboratories.

G-E MAZDA LAMPS **GENERAL ELECTRIC**

starting them on the quarterly cycle.

After the first quarterly period has passed and the plan is presumed to have been successfully launched for the customer, a rubber stamp on the face of the bill is the only further evidence of its functioning. It reads "This is an Average Bill."

In agreeing to the quarterly plan the Public Service Commission of Wisconsin fully recognized the necessity of a rubber conservation program and was very cooperative, permitting the use of average bills or postcard readings. They asked for quarterly reports on automobile mileage savings, customer reactions and costs. The company says:

"Our earlier experiments show us that the public will accept the arrangement graciously and with surprising understanding. Our experience reveals little about our costs. We estimate at least a 50 percent cut in car mileage. We have no accurate idea of our uncollectible account losses nor possible added collection expenses. There may also be some added operating department costs, as the meter readers handled complaints and other incidental work that may now have to be done at higher cost."

•

Idaho Starch Industry "Utility-Initiated"

Devising ways and means for conserving the country's resources in foodstuffs and raw materials may now be considered the "bounden duty" of utility managers and engineers. An excellent example of this comes to light in Idaho, where C. J. Strike, president and general manager of the Idaho Power Company, and R. E. Gale, general sales manager, have for some time been closely identified with the "Farm-Chemurgic" movement. They saw in the cull potatoes that are annually thrown away in Idaho a waste of almost tragic proportions. Not only were the culls wasted, but it cost money to get rid of them, while at the same time it was found that this country, up to wartime, had been importing starch to the tune of about 500,000,000 lb. annually, in turn representing much ship capacity.

The upshot of it was—these men being of the "do-something about it" type—that they interested farmers and business and professional men, and a starch factory was built at Blackfoot, Idaho, in the Pocatello division of the company. The plant got into full production last November. It is operated by the Idaho Potato Starch Company and is producing upward of 300 tons of fine quality starch from about 2,500 tons of culls per month, on about a seven-month annual production schedule.

In building the factory, where the process is essentially a conveying and grinding one from the power standpoint, hammer mills being employed to reduce the potatoes to pulp, the services of a good mechanic were required, and one of the men from the Pocatello division, Albert Carlsen, was "loaned" to the starch company.

The location of the Blackfoot plant is adjacent to one of the company's 11,000-volt lines, and a transformer bank containing three 50-kw. transformers has been installed on a pole structure near the plant. The installed motor capacity of the plant is 138 hp. and the current consumption in March, a typical month, was 32,500 kw.-hr.

A similar plant, the Magic Valley Processing Company, was also sponsored in Twin Falls, Idaho, by the Chemurgic committee and put into operation last fall. Its capacity is the same as the Blackfoot plant and it too is operating at full production.

Both plants are locally owned and financed and will bring about $135,000 into each area annually from a crop heretofore largely considered as waste. The plants each employ three year 'round employees and ten to twelve men during the 200-day operating period.

A third plant at St. Anthony, north of Blackfoot in the territory served by Utah Power & Light Company, is now being organized under the auspices of the Idaho Chemurgic committee and is expected to be ready to operate this fall. It is approximately half the capacity of the Blackfoot and Twin Falls plants.

AN EXAMPLE of utility enterprise—a new potato starch factory

•

Meter Routes Conform to Bus Routes

Changing suburban meter-reading routes to conform with public bus routes, rather than to cover a certain number of meters or a certain geographic area each day, has resulted in a substantial saving by Indianapolis Power & Light Company and is of special importance during the wartime tire shortage.

Until a few years ago all suburban and rural meters, a total of about 30,000 adjacent to the city, were covered by readers who used automobiles. Then a careful study was made for the purpose of rerouting the readers so that they could make convenient use of regular bus lines instead of the more expensive auto transportation, with the result that 55 percent of all outlying meters are now read by men using buses. The remainder, in the less accessible parts of the company's territory, are being checked carefully with further automotive economy in view. One of the proposals is for bi-monthly readings on automobile routes, with one-half of the meters read each month and the other half estimated.

Consideration also is being given to reduction of automobile mileage in collecting delinquent accounts in both city and suburbs, mainly by requiring a higher payment on delinquency at the time a credit extension is granted and then allowing more time than in the past before follow-up call is made. Tests made during the past year indicate that in a large number of cases 70 percent of the delinquent amount could be obtained as readily as the former 50 percent at the time of credit extension.

Lift the Film of "NIGHT BLINDNESS" from Industry!

In war plants all over the land MILLER Continuous Wireway Fluorescent Lighting System has raised the sights on production by lifting the level of illumination to 50 foot candles, 100 or higher . . .

99,000 out of 100,000 war plants have inadequate lighting for fast, precision production . . . according to the National Better Light Better Sight Bureau.

Inability to see clearly and sharply at all times can be just as tragic a liability to war workers as "Night Blindness" is to fighting pilots.

Today nothing less than ideal "seeing" conditions in your customers' plants, 24 hours around the clock, should satisfy you.

MILLER 50 FOOT CANDLER and 100 FOOT CANDLER will put 50 foot candles, 100 or better of man-made daylight on every working surface in their plants. MILLER TROFFERS will duplicate that performance in their plant offices and drafting rooms.

They will accomplish this at an economy and speed of installation that will pleasantly surprise even you.

The sooner you get a MILLER engineer at their plants to give them an analysis of *exactly* the working illumination they need today, the sooner they can get busy and beat their best war production promise. *Write or wire today.* (Representatives in principal cities.)

BUY U. S. WAR BONDS

MILLER
50 FOOT CANDLER
100 FOOT CANDLER
MILLER TROFFERS
Continuous Wireway Fluorescent Lighting Systems
THE MILLER COMPANY
MERIDEN, CONN.
Pioneers in Good Lighting Since 1844
• MILLER offers a complete line of filament and fluorescent lighting equipment.

NEW EQUIPMENT

Extension Cord Light

Small fluorescent extension cord light, suitable for close work and inspection, may be clipped to clothing, leaving hands

"P-7" fluorescent extension cord light. **Hygrade Sylvania Corp.**, Ipswich, Mass.

free. Unit, including auxiliaries, takes 8 watts and has low brightness. Over-all length of unit is 9½ in., weight 2½ lb. Grill is made of heavy gauge steel.

•

Limit Bridge

Electronic limit bridge for precision, rapid resistance measurements is battery-operated and self-contained in oak case. Component resistors are said to be 0.1 of 1 percent accurate and indicating meter is

"Model 670" electronic limit bridge. **Radio City Products Co., Inc.**, 127 W. 26th Street New York, N. Y.

4½-in. galvonometer having a sensitivity of 25-0-25 microamperes. Two type 1C5GT tubes are used in circuit.

•

Welding Electrode

Type "W-26" electrode; available at present in ⅛-in. and 5/32-in. diameters. **General Electric Co.**, Schenectady, N. Y.

An all-position alternating-current electrode has been developed to extend a.c. welding to both vertical and overhead positions. It is said to comply with requirements of following specifications: A.W.S. Filler Metal Specification E-60-11; Navy Bureau of Ships Specification 46-E-3, Grade 3, Class 1, and A.S.M.E. Boiler Code, Paragraph U-68.

•

Insulation

"Insl-X" waterproof synthetic insulation. **Insl-X Co., Inc.**, 857 Meeker Avenue, Brooklyn, N. Y.

Improved waterproof insulation for use on transformer cases, busbars, coils, circuit breakers, etc., is said to provide dielectric strength of 1500 v/mil., tensile strength of 2,000 lb. per square inch; resists acid, insoluble in mineral oil and gasoline; easily applied by dip, spray or brush.

•

Laminated Plastic

"Lignolite." **Marathon Chemical Co.**, Rothschild, Wis.

Strong, light-weight laminated plastic is uniformly dense, resistant to water, oil, grease and dilute acids and has high mechanical strength and excellent electrical properties. Plastic is supplied in natural black with satin or sand-blast finish, in various thicknesses from $\frac{1}{64}$ in. to 2 in. Maximum heat resistance, 80 deg. C.; dielectric strength, $\frac{1}{16}$ in., 700–900 volts per mil; dielectric constant, 4.40; power factor, 0.037; loss factor, 0.162. Adaptable to most fabricating operations and readily available without limitation as to use or quantity.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Floodlight

New all-steel floodlight, featuring a unique combination of socket housing and reflector die-formed in one piece, uses a 200-watt bulb and provides a wide beam

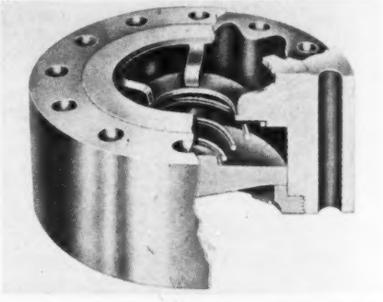
"Type L-66" all-steel floodlight. **General Electric Co.**, Schenectady, N. Y.

which may be pointed in any desired direction. Particularly adapted for areas needing light for protection against sabotage or for speeding up night work.

•

Check Valves

These valves have but two parts subject to wear—the valve disk and seat, both of which are removable and renewable. They may be used in all pump lines handling water, oil, gas, acids, alkalies and other fluids, it is stated, and are recommended for use in boiler feed, water supply and other non-return flowlines.



"Williams - Hager Flanged Silent Check Valves." **Williams Gauge Co.**, 2025 Pennsylvania Avenue, Pittsburgh, Pa.

OUT OF YOUR FUSES

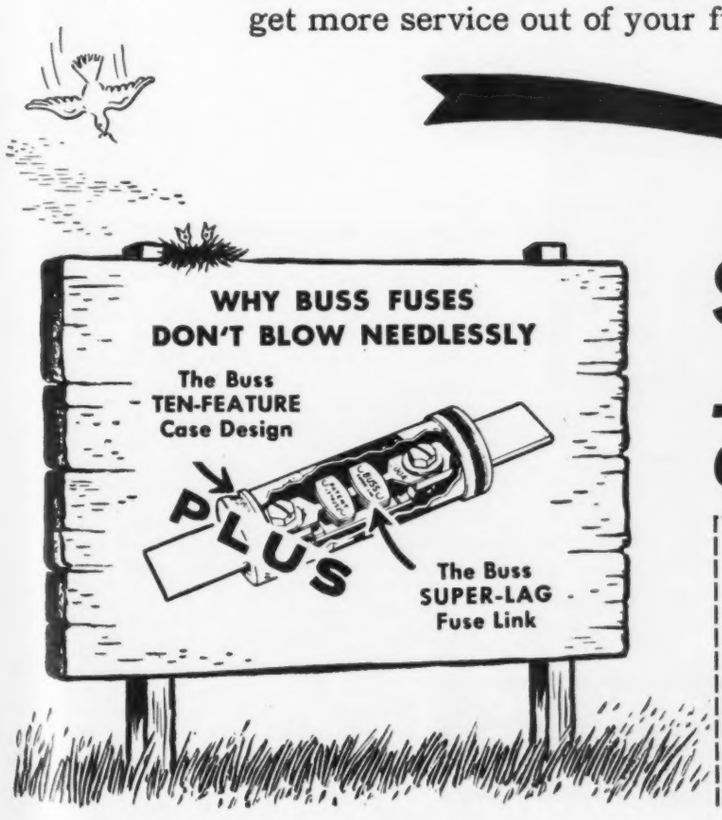
Reduce Electrical Outages . . .

PARTIAL LIST OF CONTENTS

- What to do when fuses blow
- Where to look for trouble that caused fuses to blow
- What to do after you have found the trouble
- How to select right type fuses for various circuits
- How to determine proper size fuse or Fusetron to use for different applications
- How you can save material and cut costs on motor installations
- How to recognize a reliable make of fuses

and

- a lot of other useful information that will help you get more service out of your fuses.



SAVE FUSES

. . . Send for Your Copy of this Book

BUSSMANN MFG. CO. *Division McGraw Electric Company*
University at Jefferson, St. Louis

Please send me a free copy of FUSEOLOGY.

Name_____ Title_____
PLEASE PRINT

Company_____

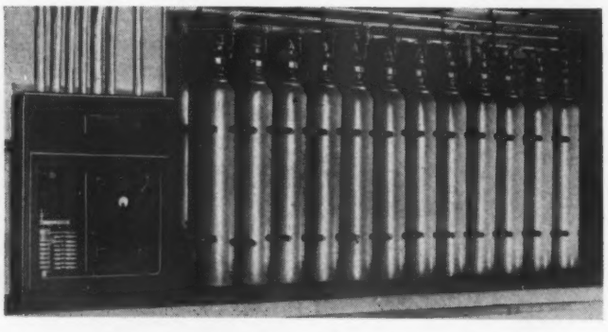
Address_____

City & State_____

His name is FIRE and uncontrolled this major saboteur can do more damage than any other element. The National Fire Waste Council has this to say, "At a time when economy and conservation can contribute so strongly to the national effort in behalf of increasing production, it becomes the duty of each person . . . in fact the whole nation to put an end to preventable waste through fire." You can kill electrical equipment, paint, oil, lacquer, alcohol and gasoline fires in split seconds with C-O-TWO*.

IT'S SAFER *because* IT'S FASTER

C-O-TWO extinguishing systems employ carbon dioxide, a non-damaging gas and one of the fastest fire extinguishing agents known to man. There are C-O-TWO portables, hose units, automatic and manual fire extinguishing and C-O-TWO Smoke detecting systems to give your plant maximum fire protection. Write today for information.



Bowlder Dam Power Plant—C-O-TWO Protected.
C-O-TWO System No. 1 and delayed discharge control unit of the 40-cylinder installation protecting two 82,500 K.V.A. Generators and Switch Compartment. Arrangement shows 24 cylinders for delayed discharge.

** C-O-TWO is a registered trademark. To be safe, specify C-O-TWO and this company's name when ordering.*

C-O-TWO FIRE EQUIPMENT CO.
NEWARK, NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada

TECHNICAL LITERATURE

CONSERVATION—Suggestions on conserving rubber in insulated wires and cables are presented in Form 6230 "Rubber Is Essential to Victory". Copies are available by writing to the American Steel & Wire Co., Rockefeller Bldg., Cleveland, Ohio.

PROTECTIVE LIGHTING—Protective lighting for industrial plants, including blackout lighting, is treated in Holophane Co., 342 Madison Ave., New York, N. Y., Protective Lighting Specific. Distribution curves are given, charts help determine number of foot-candles from refractors.

CALCULATOR — Transformer regulation slide rule has been developed to calculate the percent regulation of electrical equipment involved. It indicates reasonably accurate percent regulation for a given resistance and reactance with one setting. Copy of the Calculator, Form 3019, may be obtained from Allis-Chalmers Mfg. Co., Milwaukee, Wis.

LEAD COATINGS ON HARDWARE—To make available promptly standard requirements for lead-coated iron or steel hardware and thus effect conservation of other metallic coating materials, an ASTM emergency standard ES-2 has been issued by American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa.

WATER TESTING — The Bird-Archer Co., 400 Madison Ave., New York, N. Y., has published a 20-page booklet containing information on water testing equipment, method of making control tests, conductivity apparatus, proportioning pumps, chemical feeders. One section is titled "The Why and How of Water Analysis"—aimed particularly at those concerned with feed water regulation and control.

SAFETY VALVES—Bulletin No. 110 of the Engineering Experiment Station, Ohio State University, Columbus, describes tests on "Steam Flow Through Safety Valves". Helpful suggestions resulted for increasing accuracy of establishing rated relieving capacities of safety valves designed primarily for power boilers. Copies are $1 each.

WIRE DATA—Callite Tungsten Corp., Union City, N. J., offers a wire data chart card. Face tabulates B & S, Washburn & Moen, and Stubs or Birmingham diameters for gage sizes 1 to 50. Reverse side lists pertinent mechanical and physical data for 15 common wire materials.

LEAD-COATED COPPER WIRE — A new emergency specification ES-1 for lead-coated and lead-alloy-coated copper wire for electrical purposes is available from American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa. These specifications should, when they are widely used, effect considerable savings in certain critical and strategic elements, such as tin, used for coatings.

BELTING—"Care and Maintenance of Conveyor and Elevator Belting" is the title of a 24-page volume providing instructions as implied by the title, also engineering tables and formulas for installation or repair problems. The publication, Catalogue Section 2800, may be obtained from the B. F. Goodrich Co., Akron, Ohio.

Peg Allen's new coffee maker is helping to bring down Stukas

"I'm rushing down right now to buy another Defense Bond and get even with Hitler and the Japs! I just found out I can't get the automatic coffee maker that I've been dying to have, because the manufacturers of household appliances are making nothing but munitions. So the coffee maker and the money I'd saved will both *be helping to win the war!"*

Nowhere else on earth have household electrical appliances been so numerous, so ingenious, so inexpensive as in America. When the manufacturers in this great industry turned all their resources to building munitions, they struck a heavy blow against the Axis.

But a conversion as drastic as theirs posed some knotty problems. New designs and specifications required many new alloys, tools and methods. In cooperation with the Revere Technical Advisory staff, a number of the leading appliance manufacturers were able to change over with gratifying speed and ease. For Revere supplies industry not only with sound copper alloys, but also with a highly experienced service in the most efficient methods of using them.

Today, every ounce of copper goes directly into the essentials of modern warfare. There is none for any other use. Fortunately Revere was prepared, with new plants, advanced processes, improved equipment, to assume an important responsibility in the production of our nation's vital copper alloys. And additional facilities are steadily being added to help make victory still surer and quicker.

The Revere Technical Advisory Service functions in (1) developing new and better Revere materials to meet active or anticipated demands; (2) supplying specific and detailed knowledge of the properties of engineering and construction materials; (3) continuously observing developments of science and engineering for their utilization in production methods and equipment; (4) helping industrial executives make use of data thus developed. This service is available to you, free.

REVERE COPPER AND BRASS INCORPORATED

EXECUTIVE OFFICES: 230 PARK AVENUE, NEW YORK

NEWS ABOUT PEOPLE

T. E. Roach Assigned New Duties in Portland

Thomas E. Roach has been made vice-president and general manager of the Northwestern Electric Co., Portland, Ore. As recently as the May 30 issue ELECTRICAL WORLD announced the advancement of Mr. Roach, who was then

assistant to the president of the Pacific Power & Light Co., to a position involving full charge of the company's Washington division, with headquarters in Yakima. During recent months he has also been working with the Northwestern Electric Co. on wartime problems incident to the operations of both companies.

In commenting on Mr. Roach's appointment, L. T. Merwin, president of Northwestern Electric, said: "We are happy to have Mr. Roach in our organization. He has made a splendid record for himself in the Pacific Northwest and is thoroughly familiar with the problems and responsibilities that an electric service company faces in these trying days."

•

▶ JOHN C. PLANKINTON, Northwestern Electric Co., Portland, has been appointed assistant general manager in charge of the company's business development department. This is the title formerly held by George H. Wisting, who took leave of absence last October to assist in the organization of Columbia Aircraft Industries and recently resigned from Northwestern to join the Aircraft company on a permanent basis. Mr. Plankinton, formerly manager of commercial and industrial sales, has been acting head of the department since October.

▶ CLYDE V. HUSSEY has been named assistant to the president of the Arkansas Power & Light Co., with headquarters in Pine Bluff. Mr. Hussey was formerly division manager of the Mississippi Power & Light Co. at Jackson. Increased work brought about by government regulations and increased activities made it necessary to expand the executive personnel of the company, C. H. Moses, president, said in announcing the appointment.

▶ CHARLES H. SAGE has been elected president of the Spruce Falls Power & Paper Co., Toronto, Canada, succeeding F. J. Sensenbrenner. ERNST MAHLER of Wisconsin was named vice-president. Mr. Sage is vice-president of the Kimberly-Clark Corp., Neenah, Wis., and is officer and director of various other companies mainly in the paper or affiliated fields.

▶ DR. ARTHUR SURVEYER has been appointed general consulting engineer to the Shawinigan Water & Power Co. and its subsidiaries. Dr. Surveyer is a director of the company.

▶ ROBERT ANDERSON, Los Angeles Bureau of Power & Light, has been transferred from the operating division to the illuminating engineering staff.

R. G. Kenyon Assumes New Duties in Los Angeles

R. G. Kenyon, advertising manager of the Southern California Edison Co. for the past ten years, has been appointed assistant vice-president and Howard W. Hayes, assistant advertising manager, has been appointed advertising manager, according to an announcement made by Harry J. Bauer, president of the company.

A member of the Edison organization for 25 years, Mr. Kenyon was named assistant advertising manager in 1926 and became head of the advertising department in 1932. He previously had been employed in the company's accounting and securities departments and was assistant supervisor of employment. He is a director of the Public Utilities Advertising Association and a

R. G. Kenyon

past-president of the Los Angeles Advertising Club.

Mr. Hayes has been assistant advertising manager since 1932 and has been with the Edison company for 15 years. Before joining the company's advertising department he was on the editorial staff of newspapers in Pasa-

under thousands of
"heavy traffic" streets like this

ORANGEBURG CONDUITS

are contributing to continuity of service by providing complete and lasting cable protection

For example, the Ne Page Electric Company of Seattle, Washington is now completing the installation of *more than a carload* of Orangeburg NOCRETE for the Front Avenue Improvement Project in Portland, Oregon.

Today, *as never before*, the safest place for cable—whether it be for power, lighting, fire, telephone, or signal service—is underground . . . *in Orangeburg Conduits.*

ORANGEBURG ***Standard*** for installation *with* concrete encasement
NOCRETE for installation *without* concrete encasement

ORANGEBURG HAS BEEN A LASTING NAME "UNDERGROUND" FOR 49 LONG YEARS

Photograph by Nesmith

Build for tomorrow with

ORANGEBURG *Conduits*

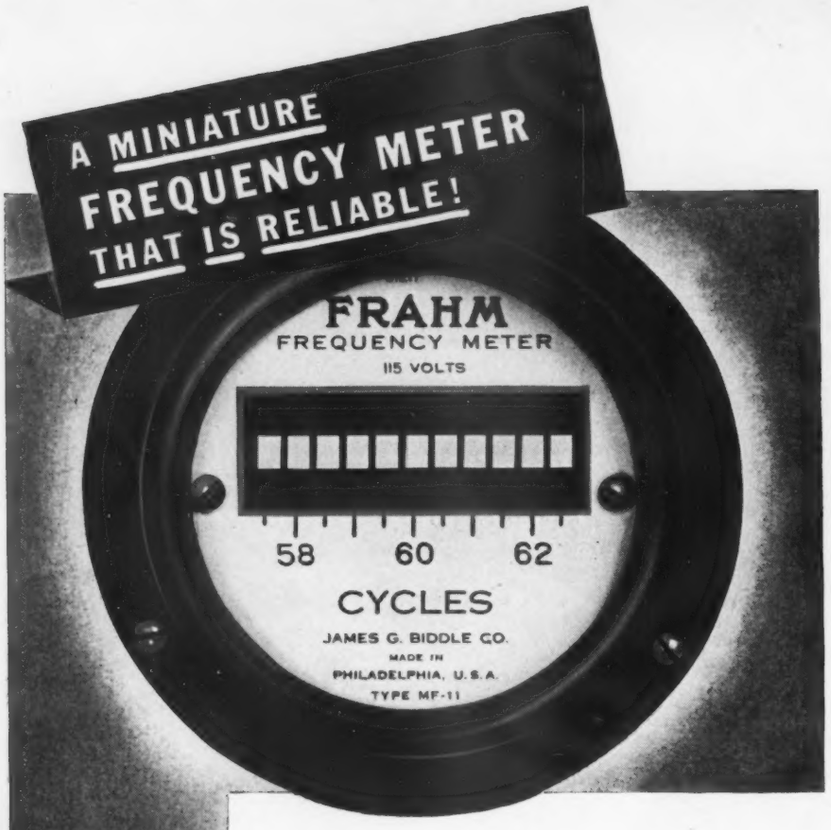
MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVENUE, NEW YORK CITY

Sales Agent—Distributors

GRAYBAR ELECTRIC CO., INC.
(offices in principal cities)

GENERAL ELECTRIC SUPPLY CORP.
(and associated houses)

7-FC-2



This Miniature Frahm Vibrating-Reed Frequency Meter (shown actual size above) is an indicating instrument without moving system or pointer. The operating principle and the method of indication are based on resonant vibration of accurately tuned steel reeds. These instruments are easy to read, ruggedly constructed, surprisingly accurate over long periods of time and are unaffected by wave form or by ordinary changes in voltage and temperature. Available in various ranges of power frequencies from 15 to 500 cycles per second; in fact, the same instrument can have more than one range.

★ "Frahm" Switchboard Frequency Meter—9" Diameter Case. Made with one or two rows of 31 reeds each, for indicating power frequencies, also for measuring frequency of harmonic ringer circuits in telephone work.

★ "Frahm" Portable type Frequency Meter. Mounted in polished walnut case 9¼" x 8½" x 4½" overall, with carrying handle. Wide range, such as 22.5 to 90 cycles per second. Arranged for various potentials from 50 to 300 volts.

Write for illustrated Bulletin 1695-W describing all types shown.

James G. Biddle Co.

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

dena, Santa Monica and Visalia, and was with the Associated Press in Los Angeles and Phoenix.

•

▶ HAROLD L. MOORE, Southern California Edison Co. sales supervisor in Santa Monica, has been appointed manager of the company's Pomona district. He succeeds Hale N. Kemp, who has entered military service. Mr. Moore has been a member of the Southern California Edison organization since 1925 and has advanced steadily in its commercial affairs. Beginning as a merchandise specialist in 1928, he was appointed heating specialist in the company's Los Angeles general office a year later. In 1931 he was promoted to sales supervisor, one of the highest positions in the domestic sales department. He served in that capacity in Visalia, Pomona, Pasadena and Santa Monica.

▶ A. W. TRIMBLE, formerly assistant treasurer of the Mountain States Power Co., has been elected vice-president and treasurer of that utility, to succeed B. E. LEE, who has resigned because of illness. Mr. Lee had been vice-president and treasurer since 1940. He was retained as an assistant treasurer.

▶ GEORGE L. NELSON has been appointed manager of the Electrical League of Utah to succeed Elias J. Strong. A practicing lawyer, Mr. Nelson for 12 years has been secretary of the Utah Furniture Association and holds similar positions with the Salt Lake Furniture and Dairy Products groups. At one time he was connected with the Utah Power & Light Co.

▶ ELLIS L. PHILLIPS, chairman of the board of the Long Island Lighting Co., recently received the honorary degree of doctor of laws from Ohio Wesleyan. University. Mr. Phillips received the same degree earlier this year from Florida Southern College.

▶ DR. JESSE E. HOBSON, director of electrical engineering at the Illinois Institute of Technology, Chicago, was the guest of honor at a testimonial dinner given recently in Milwaukee. More than fifty electrical engineers from various electric utilities attended. Dr. Hobson is nationally recognized as an authority in the analyses of power system problems, utilizing to a great extent the concept of "symmetrical components." For several years prior to his association with the Illinois Institute of Technology in 1931, he was a central station engineer with the Westinghouse Electric & Manufacturing Co. For the past eight months Wisconsin

Here's a fine OPPORTUNITY for an ENGINEER to get into TECHNICAL ADVERTISING and PUBLISHING

Here's the kind of a man we're looking for. We don't expect to find all the qualifications rolled up in one individual —but the more you have the better.

He has a technical background. It will be fine if he is an electrical engineer—or civil, or mechanical. If he hasn't a fancy degree but does possess a practical knowledge of electricity and its applications, that's O.K. too. We'd be delighted if he has worked for a utility and/or an electrical contractor.

He likes to write. It's not painful for him to sit at a desk and pour out words describing installations he has seen—what engineers say about the products they use, and the kind of information they need to help them do their jobs better. He expresses himself clearly on paper and enjoys doing it.

He has written advertising, sales promotion or publicity for a manufacture, or publication—maybe not a lot, but enough to get the taste of printers' ink and to like the flavor.

He knows something about research methods and statistical analysis . . . can work up a pretty acceptable questionnaire and handle the procedure of mailing, tabulating returns and interpreting.

He's 25-35 . . . has a natural curiosity that will make him learn rapidly and grow in his job. He's a nice guy to have around and gets along well with his fellow workers.

The job is in the Sales Promotion and Market Research Department of two of McGraw-Hill's leading publications. If you're interested in the job and possess enough of the above qualifications to put you in the running, let's hear from you promptly please.

Market Research Dept.

Electrical World

A McGraw-Hill Publication

330 West 42nd St. New York

utility engineers have been studying "symmetrical components" and their application in the solution of many problems involving power system faults and unbalanced conditions on three phase power systems. The meetings, sponsored by the Wisconsin Utilities Association, were conducted for the most part by Dr. Hobson, who originally planned the course of study. As a token of their appreciation, the engineers tendered Dr. Hobson this testimonial dinner, at which they presented to him a gift of one hundred dollars in War Bonds.

▶ MAJOR J. H. PENGILLY, vice-president of the Square D Co., Los Angeles, and manager of the company's western division, has reported for active service in the U. S. Army. He is the retiring president of the Los Angeles Electric Club.

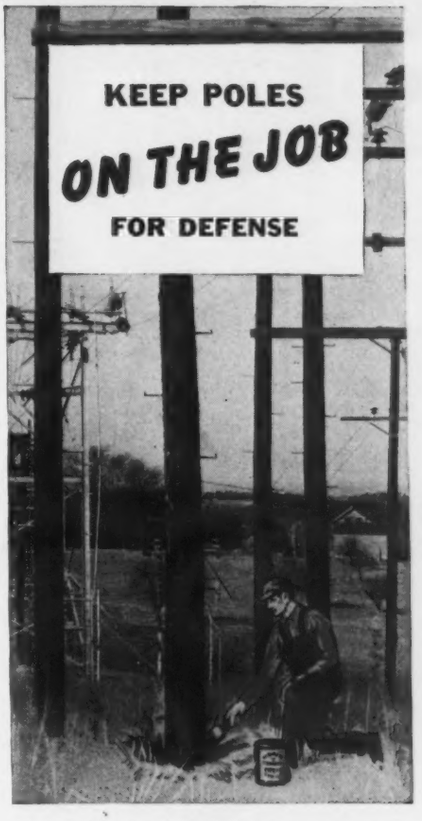
▶ ALEXANDER B. GILFILLAN has been appointed assistant to the manager of retail sales of the Philadelphia Electric Co. Mr. Gilfillan celebrated his thirty-fifth anniversary with the company last year. During his entire service with the utility he has specialized in retail sales, lighting, and small power sales work.

▶ CLARENCE A. FORREST, purchasing agent for the Central Vermont Public Service Corp., Rutland, has been elected president of the Vermont Electrical Association.

▶ FRANK COFFMAN of Harrison has been named by Governor Adkins of Arkansas as a member of the State Flood Control Commission, succeeding his brother, the late Layton Coffman.

▶ DR. ROBERT S. WILLIAMS, pioneer in metallography, has been appointed deputy dean of engineering, Massachusetts Institute of Technology, in the absence of Dean Edward L. Moreland, consultant to the National Defense Research Committee. Dr. Williams has been on the institute faculty since his graduation in 1902. He has studied metal developments in foreign countries, has been head of the department of metallurgy since 1937, and established courses in alloy analysis, spectroscopic and X-ray technique.

▶ E. E. TUGBY, sales engineer of the Pacific Electric Manufacturing Co., San Francisco, has resigned to take the position of electrical engineer in the South Pacific division office of the U. S. Engineers Corps. Prior to joining Pacific Electric Mr. Tugby was for many years in the operating department of the Puget Sound Power & Light Co. at Olympia, Wash.



● Osmoplastic treatment prevents groundline decay thus increasing standing pole life.

In these critical times, it is important that poles keep standing longer to avoid power failures. You can guard against pole failures due to groundline decay by using the Osmoplastic groundline treatment. This easy to apply wood preservative increases standing pole life by 7 to 10 years. In addition, frequent pole inspection is eliminated. Osmoplastic groundline treatment is economical, too. Service records of over 60 leading utilities compiled from over a million Osmoplastic treated standing poles prove Osmoplastic pays. Make inspection time Osmoplastic time for lowest cost pole protection.

SEND coupon below for full information

OSMOSE

WOOD PRESERVING COMPANY

Buffalo, New York

Osmose Wood Preserving Company
Buffalo, New York
Please send me complete data on the Osmoplastic groundline pole treatment.

Name_____

Company_____ Title_____

Address_____

City and State_____

How well a connector is made is quickly proven when a lineman starts to use it.

The ease with which the nut is removed from the body, perfect mating of nut and body threads, absolutely no cross threading, and wide flats for holding and tightening fully prove the value of good machining of L-M Connectors.

Most important, with L-M Connectors, the lineman does not have to use great force to get high pressure contact between conductors — another feature which results from careful machining and is a big help to the man on the pole.

LINE MATERIAL CO.
MILWAUKEE, WIS.

OBITUARY

Daniel R. Grandy

Daniel R. Grandy, Nela Park lighting executive and director of applied fluorescent lighting to wartime industries, died suddenly of a heart attack at Minneapolis on July 11. He was 49 years old.

Mr. Grandy headed up promotion of electric discharge lamps at G.E.'s Nela Park sales promotion department in Cleveland, Ohio. He was formerly assistant sales manager in charge of advertising for G.E.'s Vapor Lamp Co. until its merger in 1939 with the company's lamp department. During his 18 years with General Electric, Mr. Grandy served successively as commercial engineer with the Cooper-Hewitt Electric Co., at Hoboken, N. J., engaged in field

contact work, prepared lighting layouts for large industrial plants, and directed the sales promotion and advertising programs for G.E. Vapor Lamp Co. He entered the lighting business in 1917 when he joined the Westinghouse Lamp Co. During his seven years with Westinghouse he devoted his energies to manufacturing, commercial engineering and sales promotion.

Mr. Grandy was an active member of the Illuminating Engineering Society. He contributed numerous papers on industrial lighting problems and was a frequent speaker on that subject in many cities in the United States and Canada. He had served as chairman of the New York section of the I.E.S., and of the Hudson County (N. Y.) Safety Committee and on numerous committees of electrical groups both local and national.

•

▶ GEORGE B. MCCULLOUGH, plant superintendent of the Virginia Public Service Co., at Charlottesville, died sud-

ON THE ALERT

Night and Day Against Transformer Sabotage

Prevent Low Oil Level Hazards to Vital Equipment with Dependable

MAGNETROL

● With unceasing vigilance, Magnetrols are on the constant alert to warn of low oil level caused by treachery, carelessness or accident. With a Magnetrol on every oil-filled power transformer, the operator receives instant warning of low oil level. This warning may be given audibly by a siren or bell, or visibly by a red or green light, or both.

Possessing no bellows, diaphragm, electrodes or packing box, Magnetrols are thoroughly dependable. The simple magnetic principle on which they operate assures positive operation. *Write today for descriptive Bulletin No. 742.*

FRED H. SCHAUB ENGINEERING CO., INC.
329 West Huron Street, Chicago, Illinois

Nicopress SLEEVES

for SPLICING DISTRIBUTION LINES

for SPLICING HIGH STRENGTH STEEL CONDUCTORS

for SPLICING 2 WIRES OF DIFFERENT DIAMETER

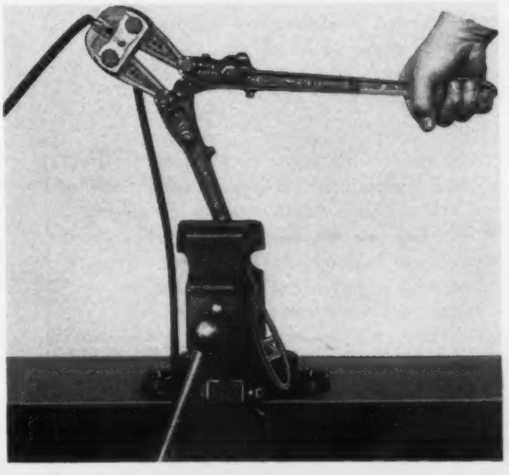
Strong, tight splices are essential to good service. Poor splices mean trouble, loss of time and increased expense. With the Nicopress Method of Splicing bad joints are eliminated, time saved, expense cut to the minimum and good joints assured.

Nicopress splices are quickly made either on the ground, or on the poles with an easy-to-handle Nicopress Tool. The completed joints exceed the rated breaking strength of the conductors and have a lasting high conductivity. All splices are neat, uniform and workmanlike and because Nicopress Sleeves are bevelled at both ends the wire pulls easily over the cross arms without snagging.

Nicopress Sleeves are available in a wide range of sizes for copper, copperweld and high strength steel conductors and for splicing wires of different diameters.

THE NICOPRESS METHOD

for Salvaging Short Lengths of Wire



NOW When metals are so urgently needed for War Production it will certainly pay you to salvage your *short* lengths of wire.

There is no better way to do this than by splicing them with Nicopress Sleeves.

The illustration at left shows how easily this can be done.

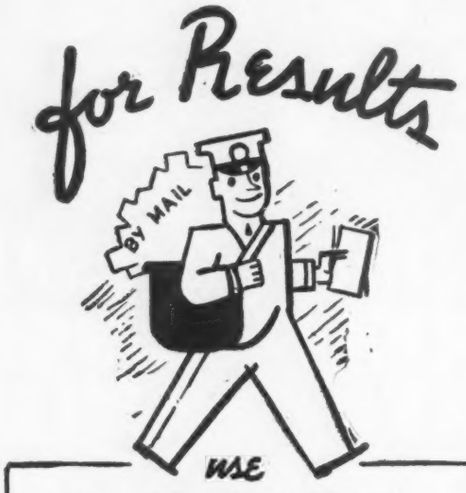
THE NATIONAL TELEPHONE SUPPLY COMPANY

Manufacturer of Specialties for Power and Communication Lines

5100 SUPERIOR AVENUE • • CLEVELAND, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.



MAILING LISTS THAT WORK...

McGraw-Hill Industrial Mailing Lists are a direct route to today's purchase-controlling executives and technicians in practically every major industry.

These names are of particular value now when most manufacturers are experiencing constantly increasing difficulty in maintaining their own lists.

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled changes in industrial personnel. These lists are compiled from exclusive sources, based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff, and are maintained on a twenty-four hour basis.

Investigate their tremendous possibilities in relation to your own product or service. Your specifications are our guide in recommending the particular McGraw-Hill lists that best cover your market. When planning your industrial advertising and sales promotional activities, ask for more facts or, better still, write today. No obligation, of course.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street **New York, N. Y.**

denly on July 6. He was 57 years of age. Before going to Charlottesville he was in charge of the company's electric plant at Bremo, Va., for a period of nine years.

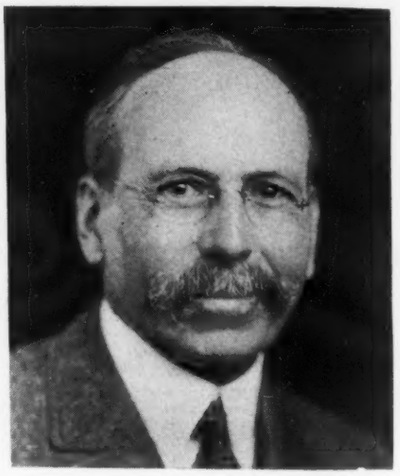
•

Henry G. Reist

Henry G. Reist, retired head of the motor and generating engineering department of the General Electric Co., died on July 5 in Schenectady, after a short illness. He was 80 years old.

A native of Mount Joy, Pa., and a graduate of Lehigh University, Mr. Reist joined the Thomson-Houston Electric Co. at Lynn, Mass., in 1889. After Thomson-Houston Electric was combined with Edison General Electric Co. to form the General Electric Co. he took charge of designs for alternating-current machinery for General Electric. He retired in 1931.

Mr. Reist was granted many patents for his inventions, notable among which was the development of fabricated structures to replace castings in electrical



apparatus. He accompanied the American Engineering Society on its trip to England and Paris in 1899, and in 1929 was a delegate to the World Engineering Congress and World Power Conference. He was a fellow of the American Institute of Electrical Engineers, a member of the American Association for the Advancement of Science, and past-president of the Eastern New York Society of Professional Engineers. He received the 50-year medal awarded by the American Society of Mechanical Engineers, of which he was a past vice-president and a fellow.

•

► HAROLD R. HENDERSON, assistant in charge of the advertising department of the Consolidated Edison Co., of New York, Inc., died on July 15 at the White Plains Hospital, White Plains.

FIGHT Electrical Fires with Rockwood WaterFOG

This new Rockwood Type N-20 Nozzle has remarkable extinguishing action on fires in such electrical equipment as transformers, oil switches, generators, regulators, etc., and inflammable liquids.

The Rockwood N-20 WaterFOG Nozzle projects a larger WaterFOG pattern a greater distance by a new Rockwood method known as the *internal* impingement principle of generating and projecting WaterFOG. This simply designed nozzle converts plain water into a combination of *high* and *low* velocity WaterFOG, the new extinguishing agent which cools and smothers fire. The *low* velocity WaterFOG with its greater extinguishing action is projected farther by means of the proper amount of *high* velocity WaterFOG induced into the *low* velocity pattern. Thus, it is possible to project *low* velocity fog into the seat of a fire and extinguish it from distances not possible heretofore.

Rockwood N-20 WaterFOG Nozzle	
¾"	$15.00
1"	15.00
1½"	25.00
2½"	35.00

Fits existing fire hose lines

Electrical fires may be attacked and put out without danger of bringing the nozzle in contact with "live" electrical equipment. Extensive tests by a prominent engineering institute prove that Rockwood WaterFOG has a very low degree of conductivity making it safe to apply to electrical equipment carrying high voltages. Approved by Associated Factory Mutuals Laboratories for use around live electrical equipment and on flammable liquid fires.

Write for WaterFOG booklets.

No obligation.

Rockwood Sprinkler Company

62 Harlow Street, Worcester, Mass.

For 36 Years Specialists in the Engineering, Manufacture and Installation of Fire Protection Equipment

N. Y., following an illness of several months. Mr. Henderson first joined the Consolidated Edison System Companies in 1924, as an employee of the Brooklyn Edison Co. Two years later he was made assistant advertising manager of the company and subsequently advertising manager. In 1936 he was transferred to the Consolidated Edison Co. as assistant in charge of the advertising department.

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Frederick A. Allner

Frederick A. Allner, president and a director of the Safe Harbor (Pa.) Water Power Corp., died on July 18 in Baltimore, Md., after a brief illness. He was 60 years of age. Mr. Allner was closely associated with the development of the Pennsylvania Water & Power Co. and with the construction of the Holtwood Dam on the Susquehanna River.

He was general superintendent of the Pennsylvania Water & Power Co. from 1911 to 1933 when he was elected a vice-president. It was in 1940 that Mr. Allner became president of the Safe Harbor Water Power Corp., to succeed John A. Walls, who resigned to comply with Federal Power Commission orders on interlocking positions in the Aldred-Baltimore system.

Mr. Allner was born in Bohemia and received his technical training abroad. He was graduated as mechanical engineer from the Technical College in Prague, where in 1914 he also received the degree of doctor of technical science.

•

▶ WILLIAM H. TRULL, 56, superintendent of construction for the New England Power Co., with headquarters in the Worcester Suburban Electric area at Marlboro, Mass., died at Westboro, Mass., on July 5. He was born in Marlboro and began work with the local utility 35 years ago in the line department.

▶ WILLIAM T. CRAFTON, superintendent of distribution for the Virginia Electric & Power Co., at Norfolk, Va., died in a local hospital on July 5 in his seventy-first year. Mr. Crafton had been identified with the Virginia Electric & Power Co. for 40 years.

▶ CHARLES J. KELLY, district manager of Pacific Gas & Electric Co.'s San Luis Obispo district for nearly 22 years, died on June 3. He had been in ill health for several years. Mr. Kelly was born in Ireland in 1883 and came to the United States as a young man. He joined the Pacific Gas organization in 1913.

MANUFACTURING-MARKETS

Prince Outlines Post-War Program

A post-war program to assure full employment of the nation's resources at that time was outlined by David C. Prince, vice-president of the General Electric Co., in a recent address before the Philadelphia Chamber of Commerce and Board of Trade.

Mr. Prince listed five points in the plan: (1) development by industry of adequate plans for converting war plants back to peacetime production with as little delay as possible; (2) development by industry of plans to utilize new materials, new processes and new products created during the war; (3) development by industry in cooperation with labor, financial and Government agencies of conditions favorable to investment after the war so that industry will be induced to make its full contribution to capital formation; (4) development by banks, insurance companies and Federal, state and local Government agencies of a balanced program for expanding residential and public works constructions and (5) development by those industries especially interested and by the Federal government of a long-term program of investment in undeveloped foreign countries.

•

Gamewell Seeks to Sell Holtzer-Cabot Electric

The Gamewell Co., Newton, Mass., will hold a stockholders' meeting in August to secure a vote on a proposal of the directors to dispose of its interest in the Holtzer-Cabot Electric Co., Boston, a wholly owned subsidiary. The Gamewell company features the manufacture of fire alarm and police telegraph systems, while Holtzer-Cabot, a long established concern in the power and industrial communication field, specializes in the manufacture of fractional horsepower motors, annunciators, call systems and interior telephone equipment. The Gamewell company acquired the other property in 1929.

•

Manufacturers Make Sales Assignments

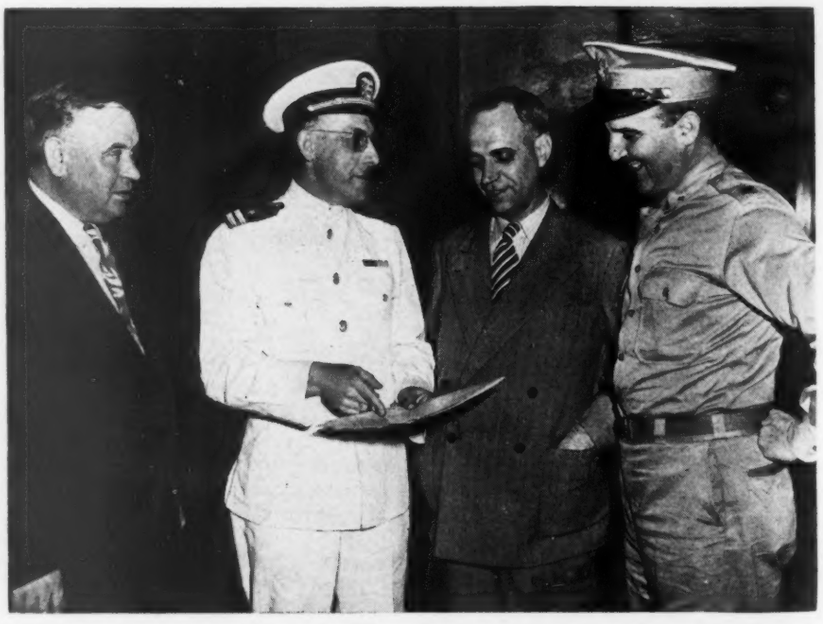
The following appointments have recently been announced by manufacturing companies:

Graybar Electric Co. has named George J. Cossmann assistant district manager of the central district with headquarters in Chicago. T. H. Beecher has become manager of the Indianapolis office, succeeding A. J. Callaway now in military service.

Rumsey Electric Co., Philadelphia, electric supplies and equipment, has announced that Robert R. Wylie, district representative located in the Norfolk area, with offices at 935 Wainwright Building, Norfolk, has just entered the Navy as ensign. Mr. Wylie's work, for the time being, will be handled by Howard S. Sheppard, who is being sent from Philadelphia to Norfolk.

R. Thomas & Sons Co., Lisbon, Ohio, porcelain insulators and line hardware, has appointed the following as manufacturer's agent in their respective territories: George I. Wright, 528 Commercial Trust Bldg., Philadelphia, Pa.; E. N. Harrison Co., 907 North Central, Knoxville, Tenn.; R. E. Brown Co., 311 Ross St., Pittsburgh, Pa. and W. J. Hugo, P. O. Box 581, Davenport, Iowa.

P. D. George Co., St. Louis, Mo., has appointed Insulation Manufacturers Corp. as distributors of pedigree insulating var-



MILITARY MEET WITH WESTINGHOUSE—Getting together just before presenting their program in three separate meetings to the factory workers of the Westinghouse Electric & Manufacturing Co., Mansfield, Ohio, are (left to right) C. L. VanDerau, company works manager; Lieut. A. E. Heiser, resident inspector of naval material; J. H. Ashbaugh, manager of the company's merchandising division, and Capt. S. F. O. Mavis, Air Corps Division, Ft. Hays, Columbus

A BETTERMENT . . .

Not a Substitute

Has there been a substitution for the "Good Old Days" Saturday night lavation?

No, the modern shower is a BETTERMENT!

Romantic as we may be, few, if any of us, would want to go back to the old tub bath in the stove-heated kitchen (often the only heated room in the house).

Neither will many of you designers and engineers want to go back to commonly used materials . . . now practically impossible to get . . . once you replace these materials, not with substitutes, but with materials designed to do a better job for you.

Getting the right NON-metallic material need not involve tedious delays for research and experiment. The CONTINENTAL-DIAMOND Laboratory has been doing experimental work of this nature for more than 27 years. Its files contain records of hundreds of difficult material problems solved. C-D is not limited to working with one or two NON-metallics, but manufactures FIVE distinctly different materials. One of these may be the answer to your "What Material?" problem.

Avoid substitute materials . . . so you won't have to go back to the kitchen-tub bath. . . . Write us today about your problems. . . . Send for Booklet GF-12.

Continental - Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

TWICE-TESTED . . . Individually Adjusted

There's a secret to making fine relays quite aside from sound design and the use of quality materials. This is summed up in just one word, "Care". Care, as we at Dunco see it, calls for painstaking inspection of individual parts before and during manufacture, a complete test of the finished unit, plus another final test which includes individual adjustment for the job it has been designed to fill.

In brief, Dunco's production objective is "Not only how many—but how well". This, we believe, is the big secret behind the widespread selection of Dunco Relays and Timers by leading users for applications where the call is for the utmost in dependability and durability. Catalog gladly sent on request.

DUNCO RELAYS and TIMING DEVICES

STRUTHERS DUNN, INC., 1319 Cherry Street, Philadelphia, Penna.

ELECTRITE

A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

DENSITE

An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department

WEST VIRGINIA PULP & PAPER COMPANY

230 Park Avenue, New York, N.Y. 35 E. Wacker Drive, Chicago, Ill.

HIGH GRADE
HARD PORCELAIN
FOR
Electrical Specialties

High and Low Voltages

IMPERIAL
PORCELAIN WORKS

TRENTON, NEW JERSEY

THE ELECTRICAL BUYERS REFERENCE is packed full of buying and specifying information, all in one handy, ever-ready volume.

Active electrical men say it's the most valuable volume in their offices. Use it yourself . . . it's *your first source of information.*

**• ELECTRICAL •
BUYERS REFERENCE**

330 West 42nd Street, N. Y. City

nishes and compounds. Offices and representatives are maintained in Chicago, Cleveland, Milwaukee, Minneapolis, and Peoria.

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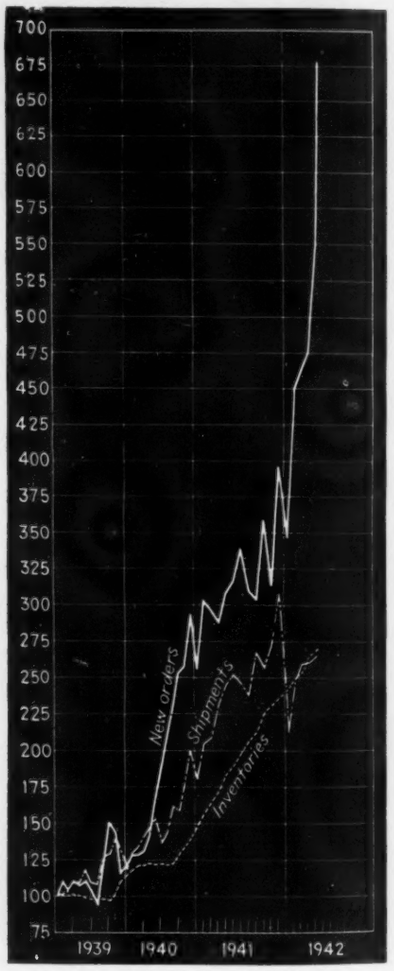
New Orders Make Spectacular Gains

Index of value of new orders received by manufacturers of electrical equipment, compiled by the Bureau of Foreign and Domestic Commerce, advanced sharply in the month of May to



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

677, an all-time high. This compares with the former record high made in April, 1942, of 548, and with 308 in May, 1941.

Electrical machinery shipments also moved upward during May, the Bureau's index rising to 266—259 in April and 207 in May, 1941.

The index covering electrical machinery inventories showed a gain of 4.8 points in May over April—269.0, against 264.2. It stood at 183.9 in May, 1941.

Field Reports on Business

Expansion of plant facilities to meet the demands for equipment is proceeding at a feverish pace. Need of electrical apparatus continues at a high rate and in wide diversification of application. Demand for workers in war centers is becoming increasingly pressing.

NEW YORK

Useful indicator of retail activity throughout the eastern area, the Federal Reserve Board announced that department store sales for the week ending July 11 were up 10 percent over the figure for the corresponding week a year ago. The week previous, there had been a 2 percent decrease compared to last year's figure. Boston, Philadelphia and Richmond showed the biggest increases, however, with jumps as high as 20 percent registered. On the other hand, independent retail stores' sales in June were 2 percent under those of May, according to a Commerce Department report. The decline was declared to be seasonal and might be partly attributed to rationing and scarcity in many lines.

Engineered construction volume for the week totalled $174,129,000, which is 57 percent below the high volume of $401,603,000 reported for the week previous and 16 percent below the corresponding 1941 week. Public construction accounted for a 58 percent drop from the previous week's figures and 12 percent below the 1941 figures. Private construction was 6 percent lower than the previous week and 55 percent below last year's week. With the present week's total, volume for the 29 elapsed weeks reaches $5,698,849,000 compared with $3,421,095,000 for the same period last year—a gain of 66 percent.

The stock market remained firm but irregular.

NEW ENGLAND

During the last thirty days, contracts for war materials valued at $86,962,944 were placed in plants in New England, according to an announcement by the Regional Office of the War Production Board. Negotiated contracts for electrical equipment recently placed include orders for several lots of wire, signalling apparatus, test assemblies, electrical supplies for wiring for light and power, radio equipment, and marine machinery. A Massachusetts manufacturer bought a 500-kw. high frequency heating furnace a short time ago; an order for 100 portable electric drills was placed with a Connecticut manufacturer recently, about $15,000 worth of radio apparatus including audio oscillators and locking tone keyer oscillator units was awarded to a Massachusetts company this month, and sizable orders for heavy machine tools which reflect sales of small motors and control apparatus sustain at a high level industrial power equipment movement.

Demands for electrical apparatus continue at a high rate and in wide diversification of application. Specifications are being studied and prices submitted for 23 electric motor driven stacking and tieing machines, 500 portable electric bakers, a large quantity of intricate electrically operated medical apparatus, of which 50 motor driven testing metabolism units are good examples of the latter, capacitors and transformers, and electrical supplies for building construction ranging in lots from about $3,000 up. Manufacturers in this district recently bid on 25 portable blowers and a group of 1000 toggle switches.

Limitations on new construction to conserve materials and orders to defer projects not immediately necessary and to simplify designs and specifications are restricting the outlet for future movements of supplies for light and power. Material shortages and priority regulations have stimulated reconditioning of electrical power equipment.

CHICAGO

Effects of the war program are being more acutely felt in this area as the number of orders for material continue to mount. Expansion of facilities to meet the demands for equipment is proceeding at a feverish pace with the result that total production of armament material will continue to increase greatly before reaching capacity. Upon completion of the new plants now under way a total of 225,000, with an annual payroll of $478,000,000 will be directly employed in war industries in this area.

The impact of the enlarged payroll should help electrical dealers who have or will branch out in other lines to maintain a survival status. Of 33 manufacturers reporting June sales to the Electric Association, 18 showed increases over May while 17 had gains over June, 1941. For the first six months 19 reported increases over the same period last year.

Electrical permits show a large number of motors being installed. Six plants last week installed 151 motors totaling 1076 h.p. Bodine Electric Co. reports the demand for motors has increased sales for the first six months 400 percent over the same period in 1939.

Public Service Co. of Northern Illinois is taking bids on a substation to be built in Cook County. Hydro Electric Co-op will build a 20,000 h.p. power plant, costing approximately $3,500,000 in Iowa.

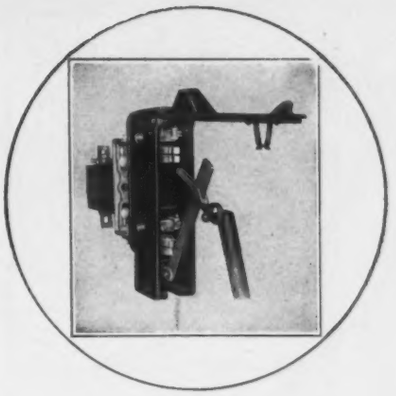
PACIFIC COAST

Coast wholesalers organizations have been cut about 20 percent by service induction, this percentage of decrease being greater where appliances were stressed and less where government volume of business has required replacements, principally in the warehouse.

There is a noticeable dearth of electrical machinery bidding just at present typical in size being $1,850 for a Pacific Electric Manufacturing Co. circuit breaker for Bonneville and $1,003 for two 7½ kv. Kelman breakers for City of Burbank. A 65-mile 69 kv. wood pole line of #2 copper is to be built from Parker Dam to mines at Bagdad, Ariz.

Building permit value for the seven western states dropped 25 percent in June from May, and 70 percent from last June, this average being maintained pretty well over the entire territory. Los Angeles figures are representative of decrease in private building, being $1,969,523 for June, 1942, $2,454,475 for May, 1942, and $9,307,365 for June, 1941.

Industrial developments providing a high priority electrical installation include a plate shop for Kaiser yard near Portland; extensive lumber developments in the Placerville region; dehydrating fruit and vegetable plants; and aluminum extrusion plant in Arizona; a 75-ton daily output steel plant and new shipyards for wooden ships and barges, all in California.



200 Ampere, Catalog 275

Compact

A New Jersey engineer had the fallacious idea that he couldn't get eighteen 400 ampere disconnecting switches in an available space of 21 feet.

Then he learned that Matthews Disconnecting Switches were only 3⅞ inches wide in the 200 and 400 ampere ratings and only 4¾ inches wide in the 600 ampere rating, and that they are all rated 7500 volts. His problem was solved and he had ample space to do a neat job.

This is their tenth year of successful service. Thousands are in use all over the country. Send for Bulletin

Do you want to examine a sample? It will be sent prepaid on request, on loan account.

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

600 Ampere, Catalog 675

It Makes No Difference

Whether You Are Using

COFFING HOISTS

Or Hoists of Another Make

IT'S UP TO YOU TO

Help Win This War

By giving your hoisting equipment proper care. Hoists are made to assist you in speeding up your production, construction, materials handling and maintenance work. See that your hoists are well lubricated at all times. Protect them from dust, dirt and moisture that causes deterioration. Above all, don't abuse hoists with extreme overloads. Repairs require time and labor and during these busy times parts are not always available. So let us repeat: Take the best possible care of your hoists during this emergency.

COFFING HOIST COMPANY
DANVILLE, ILLINOIS

Ratchet Lever Spur Geared
And Electric Hoists
Write for Free Catalog Number EG-6

ILSCO
SOLDERLESS CONNECTORS

SIMPLE . . . *in design*

SOUND . . . *in construction*

For speedy electrical connections.

Ilsco APPROVED SINGLE HOLE SOLDERING LUGS

Side formed. Wire size stamped on barrel of each lug. Smooth tongues . . . straight barrel ends. Clean! Made from maximum conductivity *seamless* copper tubing.

MAIL THIS COUPON TODAY

Please rush us sample and catalog

Firm Name.....
Name .....
Address .....

ILSCO COPPER TUBE AND PRODUCTS, INC.
5629 MADISON ROAD — — — CIN., O.

Amendments to N.E. Code Approved

Chairman of the Electical Committee, NFPA, has announced that tentative interim amendment proposals Nos. 49, 52 and 55 have been approved by letter ballot and are recommended for application in the administration of the National Electrical Code.

Amendment No. 49 provides that, under certain conditions, outlet boxes used with non-metal-enclosed wiring systems must be of the non-metallic type.

Amendment No. 52 removes the former code requirement that the grounded conductor of the secondary distribution system must be carried to each service.

Amendment No. 55 is primarily a correlating change, involving the inserting of a new sub-paragraph and the renumbering of present sub-paragraphs.

•

I.G.E. Gets Equipment Order from Brazil

Orders for several million dollars worth of electrical equipment to be installed in a new steel plant now being built in Brazil have been placed with International General Electric Co., the Brazilian Purchasing Commission has announced.

The new mill is being built by the National Steel Co. of Brazil at an estimated cost of $50,000,000. International General Electric will furnish main drive equipment for the mills, control equipment and two 6,250 kw. steam turbine generators for the power plant.

•

Watthour-Meter Movie Showing Extended by G.E.

"West Lynn," a Kodachrome sound motion picture on watthour meter manufacture, exhibited by General Electric Co., has attracted in the past few months a combined audience of more than 3,000 in industrial centers throughout the country. Plans are being made to extend the showing of the film throughout the summer and fall.

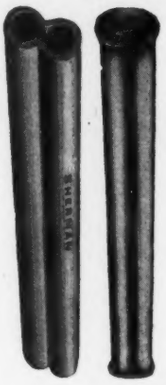
The picture has been displayed as part of a program offered by General Electric to help utilities train new employees of their meter departments. The program includes, besides "West Lynn," a brief explanation of the watthour meter and its contribution to war production, and a discussion of two new testing devices—the photoelectric watthour meter tester and the device which goes hand in hand with it, the rotating standard.

This three-reel, 30-minute motion picture is on 16-millimeter film.

Sherman
SPLICING SLEEVES

Precision Made for Enduring Service

Split Tinned Sleeve



the "Figure 8" Seamless Oval

These Sherman Splicing Sleeves make the finest of joints — strong, secure, free from corrosion. All sleeves made to accepted standards of the electric utility trade, stamped for identification, and carefully packed. For uniformity and unfailing dependability, standardize on Sherman sleeves.

H. B. Sherman Mfg. Co.
Battle Creek, Michigan

Write—for Sherman catalog illustrating the complete Sherman line of Electrical specialties and giving full specifications.

HERE'S HANDY HELP

for solving technical and business problems

When you want information fast — for dealing with difficult production problems, for settling special managerial questions, or for handling the "1001" situations that arise in every shop, office, laboratory and field—

get the facts—experience—data you need to solve your particular problems from

McGRAW-HILL BOOKS

NEW 302-PAGE 1942 CATALOGUE NOW READY!

Here is your free guide to practical, expert information on scores of subjects—from Accounting to Zoology. It contains clear, concise descriptions of more than 2000 authoritative, informative books written by leaders in industry, business, engineering and the sciences. For your copy fill in and mail coupon. (Also note on it subjects of special interest on which you desire detailed information.)

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McGraw-Hill Book Co., Inc., 330 W. 42 St., N. Y.
Send me a free copy of the New 1942 Catalogue of McGraw-Hill Books. I want to know more about:

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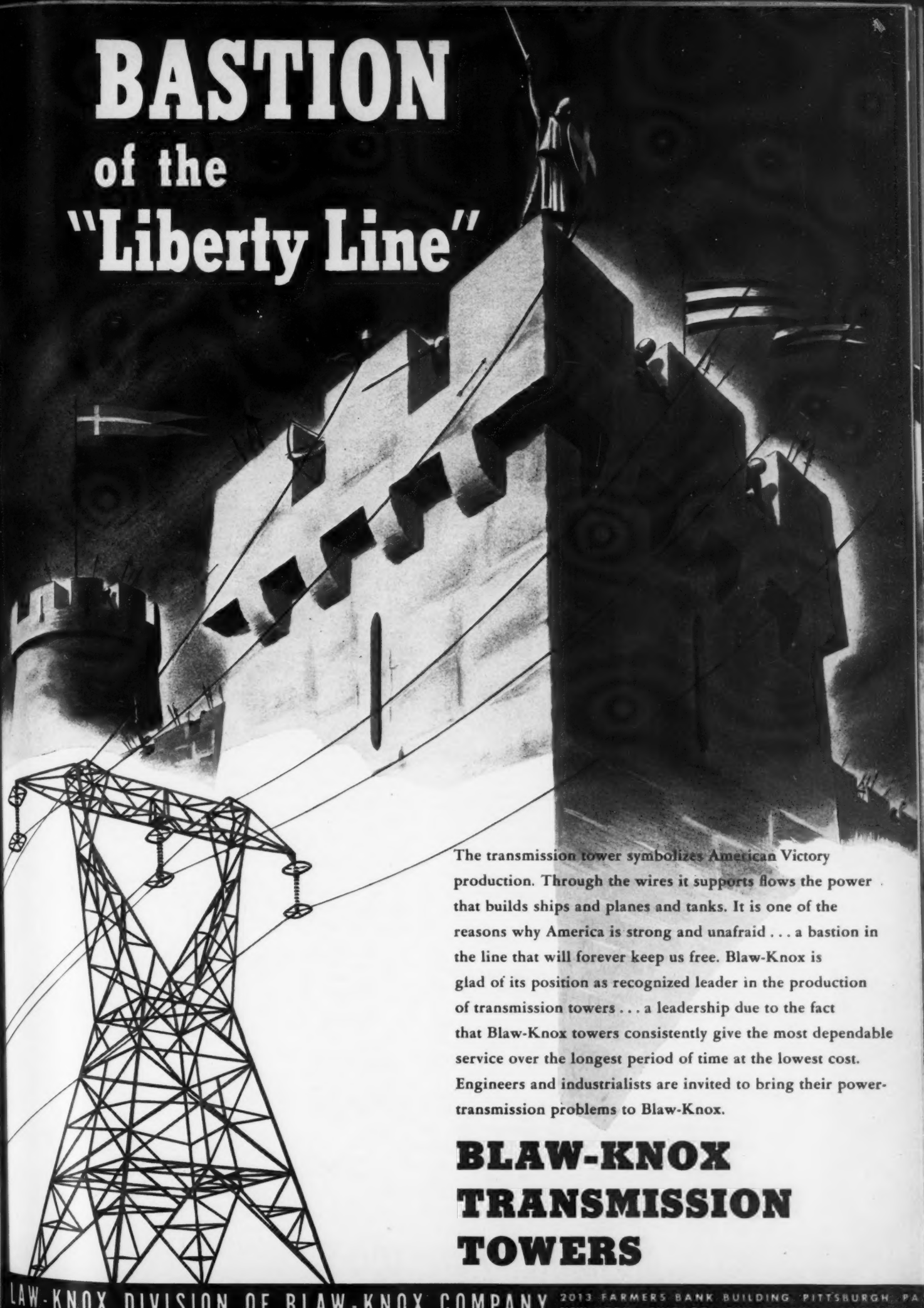
BASTION of the "Liberty Line"

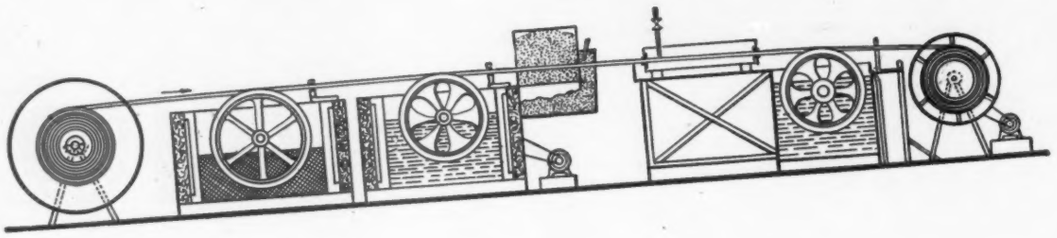


The transmission tower symbolizes American Victory production. Through the wires it supports flows the power that builds ships and planes and tanks. It is one of the reasons why America is strong and unafraid . . . a bastion in the line that will forever keep us free. Blaw-Knox is glad of its position as recognized leader in the production of transmission towers . . . a leadership due to the fact that Blaw-Knox towers consistently give the most dependable service over the longest period of time at the lowest cost. Engineers and industrialists are invited to bring their power-transmission problems to Blaw-Knox.

BLAW-KNOX TRANSMISSION TOWERS

LAW-KNOX DIVISION OF BLAW-KNOX COMPANY 2013 FARMERS BANK BUILDING PITTSBURGH PA
NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM

WAR
is engineered scrap



This war machine was built from an old pulley, the rear wheels of a truck and odds and ends of sheet steel.

It will never fire a projectile nor drop a bomb. But if our enemies really understood America it would frighten them.

The function of this scrappy gadget is to renew the weather-proofing on electric power wire . . . wire that would otherwise have to be junked.

▶ But war teaches us to look beyond machines to the hearts and minds of the men who make them.

In such perspective the device shown above takes on deep significance. It becomes a mechanical parable on the ingenuity of men whose job it is to keep electric power flowing to the vital war industries, regardless of shortages of copper, steel, rubber, aluminum.

▶ There are hundreds of such parables in every war-converted industry. Here are just a few from our great electric power plants:

. . . tons of bolts are being saved by a new method of rigging crossarms on electric poles.

. . . a southern generating station found its dam weakening. To keep the power flowing, holes were bored through the concrete and the dam bolted to bedrock!

. . . to avoid a shutdown, a middle-Atlantic utility worked out a method of stopping leaks around the giant valves controlling its water supply by mixing *sawdust* with the water. It worked.

. . . a western company bought old suspension cables from the wrecked Tacoma Bridge, untwisted them and used the metal as concrete reinforcement.

So goes the saga of electric power, as the industry does its share in the common task . . . With much of its trained man-power in the services, with priorities available only in the most urgent cases, the American utilities are showing the stuff American management and labor are made of.

But where are the stories of plants rushed into being almost overnight to supply electric energy?

As an American, you can thank your lucky stars such stories are few. Generating plants and power lines take years to build. For instance, our country's power equipment at the start of the war represented an investment of more than the present combined cost of the two-ocean navy and lend-lease expenditures.

War conversion for this vigorous industry was almost as simple as pushing the light switch on your reading lamp. The power was there because energetic managements had created it in the normal course of American life.

Some rush construction was necessary, but the electric power industry was first in war *because* it had been first in peace.

▶ The story goes back to the depression years. The utilities were the first to shake off the doldrums. By 1935, they had already passed 1929 levels.

. . . By the time the war broke out in Europe, America's giant electrical capacity surpassed that of any combination of potential enemies.

. . . It has grown since then, with 3½ million kw. capacity scheduled to be added in 1942. This year, the industry also will spend 150 million dollars on maintenance alone.

▶ Because of these private expenditures, because the electrical companies started years ago to sell women on the convenience of electrical home appliances . . . and because the industry has always built in advance of demand, it was ready for either peace or war, with the world's greatest system of power production and distribution.

★ ★ ★

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W. P. B. . . . this advertisement is published by the McGraw-Hill Network of Industrial Communication.

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42nd STREET • NEW YORK

WITH A POSTSCRIPT

FOR BUSINESS EXECUTIVES

PERHAPS you saw the advertisement on the opposite page, in the newspapers.

Did you notice those five examples of the way in which maintenance men are meeting the problem of war operation?

That's what this page is about.

If one public utility maintenance man works out a new way of reconditioning wire, his idea becomes really valuable to the country when all maintenance men with a similar problem find out how he did it.

If one man experiments with silver and bismuth as a substitute for tin solder, that becomes great news for a man who needs tin solder and can't get it.

That's why industry after industry has been able to meet the war production challenge . . . by swapping ideas.

▶ In industry, this idea swapping is done mostly through the editorial and advertising pages of the industrial press.

McGraw-Hill, for instance, keeps 153 editors and 725 engineer-correspondents busy digging up new methods of doing things.

Industrial advertisers, too, often send men into the field to discover new ways of making their products do more work, or last longer.

When such practical editorial and advertising information is distributed to the readers of the 23 McGraw-Hill publications, the value of each idea is multiplied by thousands.

So valuable is this interchange of technical information that many companies are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

▶ If you would like suggestions as to how to conduct such a survey, just write to Reading Counselor Department, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York.

★ ★ ★

THE McGRAW-HILL NETWORK

More than 1,000,000 of the executives, designers and production men, who give America her world supremacy in technical "know-how", use the editorial and advertising content of the 23 McGraw-Hill publications as a means of exchanging ideas.

THE McGRAW-HILL BOOKS

Technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 WEST 42nd STREET • NEW YORK

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Textile World
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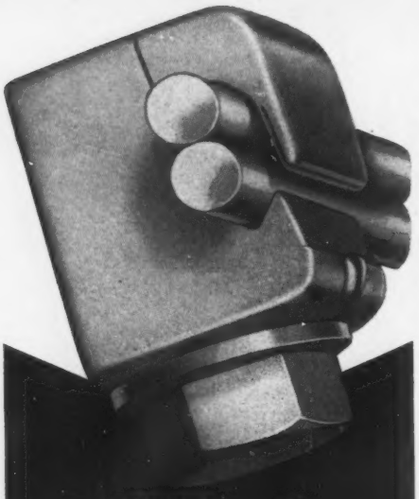

you'll like these

FARGO FEATURES

1. Precision machine cut threads
2. Wide clamping areas
3. V-Grooves for perfect alignment
4. One-piece construction
5. Vise-like gripping

WHAT THEY MEAN TO YOU

These features give you a connector which provides high compression at low wrench force, high pressure contact between conductors, vibration-proof connections and many years of reusable life.

Next time specify FARGO the connector that "grips like a vise."

Made by

FARGO MFG. CO.

distributed by

LINE MATERIAL CO.

MILWAUKEE WISCONSIN

Sales Opportunities

MISSOURI—Springfield Gas & Electric Co., Springfield, has approved plans for addition to steam-electric power plant for expansion in steam division, with installation to include new high-pressure boiler, pumps, fans, water heaters and auxiliary equipment. Cost close to $225,000. Work is scheduled to begin soon.

MARYLAND—Bethlehem Steel Co., Baltimore, has plans maturing for expansion in power plant at mill. Also will build a new three-story shop, about 50 x 400 ft., with electric installation for operation. Entire project is reported to cost over $350,000 and will be carried out at early date.

NEW YORK—War Department, Washington, D. C., has authorized new air force training school in New York. Complete electrical equipment and facilities will be installed for industrial, airfield and residential service. A power substation will be built. Entire project will cost over $3,000,000. Alexander D. Crosett Co., Inc., 512 Fifth Avenue, New York City, is architect and engineer. U. S. District Engineer Office, 270 Broadway, New York City, will supervise construction.

NEBRASKA—Stanton County Rural Public Power District, Stanton, plans extensions in primary and secondary lines in part of Stanton County, with service facilities. Application has been made for permission.

INDIANA—Continental Roll & Steel Foundry Co., 144th Street, East Chicago, manufacturer of steel rolls, castings, machinery, etc., plans power plant at new works in Indiana for production for government. Project will include several large one and two-story buildings for forge shop, foundry, machine shops and other structures, with complete electrical installation for industrial service. Cost about $40,000,000, with financing through Defense Plant Corporation. Work is scheduled to begin soon. Shaw, Naess & Murphy, 80 East Jackson Boulevard, Chicago, Ill., are architects.

CONNECTICUT—United Illuminating Co., New Haven, plans new transformer station for distribution service, on site on Kimberly Avenue. Permission has been granted by city zoning board and work will be carried out at early date. Line extensions will be made in that area.

TEXAS—War Department, Washington, D. C., has plans under way for two military cantonments in Texas. Complete electrical equipment and facilities will be installed for industrial and residential service. Power substations will be built. Each is estimated to cost about $2,000,000, with supervision by U. S. District Engineer Office, Galveston.

MISSOURI — Curtiss-Wright Corp., 30 Rockefeller Plaza, New York, N. Y., plans expansion in branch aircraft-manufacturing plant in Missouri, comprising several one-story buildings, with complete electrical equipment for industrial service. Cost estimated about $3,000,000, with financing through Defense Plant Corporation. Albert Kahn Associated Architects &

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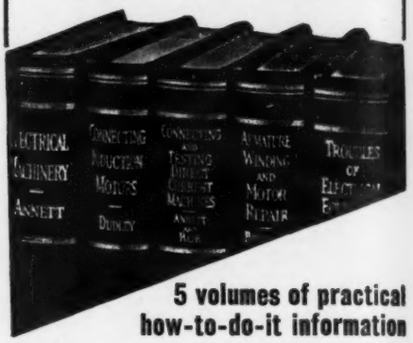

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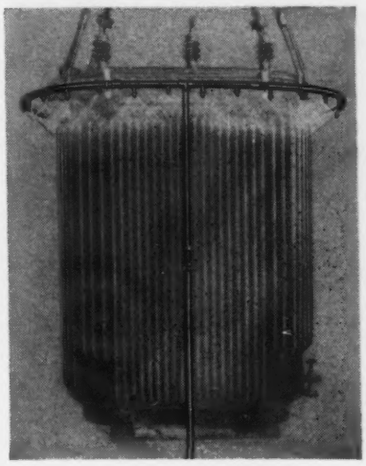

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Engineers, Inc., New Center Building, Detroit, Mich., is architect and engineer.

KANSAS—City Council, Coffeyville, plans extensions in transmission lines for power service for a government development, where power substation will be located. Special election has been called on August 4 to approve bond issue of $97,000 for this and other municipal work.

PENNSYLVANIA—Pennsylvania Power & Light Co., Allentown, has plans for expansion in steam-electric power plant, for increased capacity in steam division. Work will include installation of new boiler unit and auxiliary equipment. Project will be carried out soon.

ARIZONA—War Department, Washington, D. C., has authorized new air corps training school in vicinity of Kingman, comprising large group of buildings. Complete electrical equipment and facilities will be installed for industrial, airfield and residential service. A power substation is planned. Complete project will cost over $3,000,000, and will be supervised by U. S. District Engineer Office, 751 South Figueroa Street, Los Angeles, Calif.

TEXAS—U. S. Engineer Office, Denison, has secured appropriation of $10,950,000 for Denison Dam and hydroelectric power project for fiscal year beginning July 1, including construction, purchase of equipment, engineering work, etc. Project is now about one-half completed. Bids for required work and equipment will be asked from time to time.

COLORADO—E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., manufacturer of explosives, industrial chemicals, etc., has concluded arrangements with government for construction and operation of new plant in Colorado, comprising several large one and multi-story buildings, with complete electrical installation for operation. A power substation is planned. Cost estimated over $3,000,000, with financing through Defense Plant Corporation. Work will begin soon and will be carried out under supervision of U. S. District Engineer Office, Denver.

WYOMING—Bureau of Mines, Department of Interior, C and Eighteenth Streets, N. W., Washington, D. C., will install complete electrical equipment and facilities in new pilot ore-treating plant and laboratory on campus at University of Wyoming, Laramie. Cost about $300,000. Appropriation has been arranged and work is scheduled to begin soon.

LOUISIANA—War Department, Washington, D. C., has authorized plans for new military cantonment in Louisiana, comprising large group of buildings. Complete electrical equipment and facilities will be installed for industrial and residential service, including underground installation. A power substation is planned. Cost about $2,000,000. U. S. District Engineer Office, Vicksburg, Miss., will supervise project.

WASHINGTON—Department of Lighting, Seattle, has taken out permit for new one-story indoor-type power substation, about 31 x 61 ft., on Thirty-ninth Avenue South, and will begin superstructure soon. Cost reported about $60,000, with equipment.

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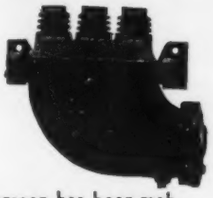

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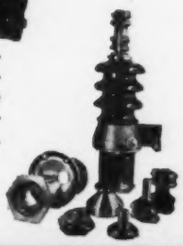

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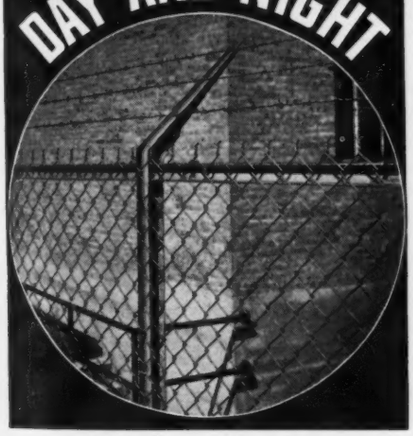

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Underwriters Revise Plug Receptacles Standard

Underwriters' Laboratories, Inc., has just published the third edition, June, 1942, of its standard for attachment plugs and receptacles.

With the printed edition of the standard are transmitted the emergency requirements which apply only for the duration of the war. These cover the use of substitute materials or construction which is necessitated by shortage of materials usually employed.

The standard supersedes the second edition of September, 1939. Copies may be obtained from Underwriters Laboratories, Inc.

•

100% Bond Subscription

All employees of the Westinghouse Electric Elevator Co., Jersey City, N. J., are now participating in the purchase of war bonds through the U. S. Treasury Department's payroll deduction plan. In one department, employees have subscribed 23 percent of total salaries for the purchase of bonds.

•

Restrict Data on Copper

To conform with the requirements of the Office of Censorship, the Copper Institute has announced that the circulation of copper statistics will be restricted in the future to members of the industry only and will be available no longer for distribution to the public or for publication.

•

Open Instruments School for Wheelco Employees

A school to enable plant and office employees to gain a greater knowledge of instruments, their construction and their use by America's war industries, has been established by Wheelco Instruments Co., Chicago.

"We believe a clear understanding of industry's use of instruments, particularly how they are used to save time and labor, to lower costs, and to provide exact control of processes by companies engaged in the direct manufacture of war goods, will stimulate employees' interest in the vital part they, as instrument makers, are playing in our war program," said L. W. Wheeler, company president, in announcing the course.

Classes are held weekly. The course has been planned by Theodore A. Cohen, vice-president and chief engineer of the company, who will be aided as principal lecturer by other members of the organization and representatives of other companies.

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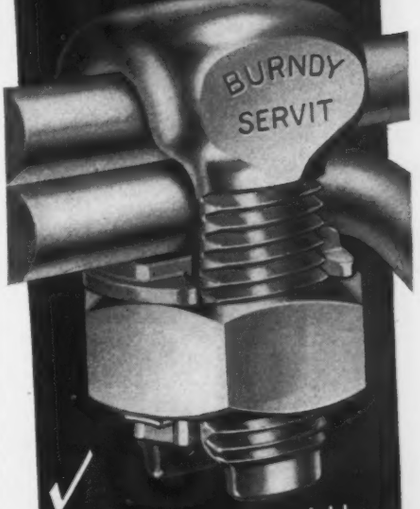

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Provo Tests Tie With Power Pool

Feasibility of interconnecting the municipal power system at Provo, Utah, into a huge wartime emergency power pool was demonstrated in tests recently completed, according to J. Hamilton Calder, Jr., chairman of the Provo utilities board.

The tests were made at the suggestion of the Utah War Emergency Power Association, a wartime organization formed last January to correlate power, equipment and man-power resources of the state's private and municipal utilities to assure their maximum performance under stress. The tests tied Provo's 6,500-kw. steam-electric generating station into the five-state northwest power pool, whose more than 250 generating stations have generating capacity of more than 3,000,000 kw.

At first Provo received from the pool varying amounts of power up to a maximum of 1,590 kw. Then the process was reversed and Provo's steam units generated power in excess of the city's needs until they were feeding a maximum of 1,150 kw. into the pool.

•

Northwest Companies Inventory Reserves

Seventeen utilities and municipal and federal power operators in the Pacific Northwest have listed a large volume of reserve man-power, materials and apparatus available for loan to distressed systems in the war emergency, according to Berkeley Snow, executive secretary of the Northwest Electric Light and Power Association. Progress report No. 1, issued by Mr. Snow, sets out a 42-page consolidated inventory of the reserves.

The inventory of the reserve supplies of the seventeen participants to date includes man-power (line crews and trucks and station maintenance men), generators, exciters and accessories; boiler and condenser tubes; steam plant auxiliaries; motors, transformers, transit oil, circuit breakers, voltage regulators, high-voltage bushings, cable and transmission insulators.

•

Restrain Amherst Plant

Village of Amherst, Ohio, has been permanently enjoined from purchasing machinery and equipment for its $250,000 municipal electric power plant. Common Pleas Judge E. H. Savord of Sandusky, who was assigned to hear the latest of several taxpayer suits, issued the injunction, holding that the Board of Public Affairs acted without authority when it advertised for machinery bids in disregard of a resolution previously adopted by the village council, directing the board to make no further commitments until pending legislation involving the plant was terminated. The building for the equipment has already been erected.

•

York Backlog Rises; Earns $784,000

In an interim statement to stockholders, S. E. Lauer, president of the York Ice Machinery Corp., York, Pa., reports that earnings for the six months ending March 31, are estimated to be $784,000 (before income and excess profits taxes, surplus charges and other reserves customarily established at the year end), compared to a $70,000 loss in the similar period of the preceding year.

Uncompleted orders not reflected in earnings at March 31, 1942, amounted to $14,659,256, or an increase of 104.4 percent over the same date a year earlier. The company's announcement indicates that in view of rising costs and price ceilings it is not likely that the same degree of earnings improvement can be expected to continue.

•

Dividend Announcements

Babcock & Wilcox Co. has voted a dividend of 25 cents a share, or half the amount distributed in April this year and July a year ago. Following the board meeting, A. G. Pratt, president, said the company's gross earnings for the year to date have been satisfactory, but uncertainties in respect to federal taxes and undeterminable contingencies caused the directors to reduce the rate.

Revere Copper & Brass, Inc., declared a dividend of $33.25 a share on the 7 percent cumulative preferred stock, clearing up all arrears on the issue. The dividend covers nineteen quarterly periods from November 1, 1931, to July 1, 1936. It is payable on August 1 to holders of record of July 10.

Blaw-Knox has declared a dividend of 10 cents, representing a 5-cent reduction from the four previous payments of 15 cents. The dividend is payable August 1 to stockholders of record July 9. William P. Witherow, president, explained that there could be no definite dividend policy in view of the unsettled tax situation and other uncertainties growing out of the war economy.

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OPERATING ENGINEER 20 years experience, 12 years experience switch board operator. PW-61, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

(Continued on the opposite page)